THE GLASS INDUSTRY

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Let's Speak Their Language

FROM a technical viewpoint the glass industry, as in many other fields, is generally thought of as being divided into two groups, the theoretical and the practical. The "theoretical group" includes those engaged mainly in fundamental research, the "practical group" are, for the most part, technical plant men concerned largely with technical problems of a practical nature.

It has been felt for some time that the Glass Division could serve as a "clearing house" for both groups but it has been the sad experience of many membership committee chairmen that when trying to interest this latter group in the activities of the Glass Division it is found there is an almost total lack of interest. On tracing down the reason one invariably hears: "We can't understand what the 'theoretical group' is talking about, although we would like to as it may in some way apply to our own problems."

That this situation may be due in part to the language used by the "theoretical man" in reporting his work, rather than to the nature of the work itself, has been indicated by Stuart Chase in his book "The Tyranny of Words." Chase states, "When the speaker is a scientist or a technician, versed in the jargon of his trade, and when the listener wants to learn about earthquakes or bacteria or the technique of marginal trading in Wall Street, then speaker and listener must work hard together, finding common referents. The former keeps his technical terms at a minimum, the latter locates referents as rapidly as possible and adopts the proper technical terms for them. With patience and a little understanding the communication gulf can presently be bridged."

One doesn't need to take much searching of the memory to recall certain papers which have been presented before the Glass Division that were so full of technical terms, abstract words and other embellishments that a dense mental fog was created in the minds of many of the listeners after the first few minutes of the presentation, with the result that what worthwhile information the paper may have contained was entirely missed.

At a recent meeting of the Society of Glass Technology in his discussion "Some Aspects of Research" Dr. J. I. O. Mason, Vice Chancellor of the University of Sheffield, brought up the same subject.

Mason encourages those who write technical papers to "Cut out every single word or phrase that does not add something definite to the meaning and only clutters up the sentence; abolish all the hackneyed expressions and the embellishments and stylish turns over which, perhaps, you had licked your lips; beware of borrowing seductive words—like 'postulate,' 'hypothecate,' or 'data'—without making sure you really know their true meanings and usage; substitute ordinary English for technical lingo where ordinary English will give the full meaning; try to replace the long abstract and Latinized words by short and concrete words."

Mason also gives the following example as a means of illustration: "Listen to this excerpt; it is not an abnormal specimen: 'In regard to the case of this glass, experimental investigation discloses that the material possesses an enhanced diathermancy at elevated temperatures.' Would it have been any less exact, and would it not have been better, to clear away all this slovenly, and yet pretentious verbal pomposity, and to say, 'When this glass is hot it is found to let through heat rays more than when it is cold?' The number of words is about the same; the number of syllables is cut down from fifty to eighteen; and so the eye and brain of the unfortunate reader are allowed to go straight to the meaning without obstruction."

While it is recognized that the technologist must be meticulous in his work and precise in the presentation of his research, surely his information can be imparted without ostentatious pedantry.

However, this is not meant to imply that one should go to extremes such as, for example, the adoption of Basic English with its list of eight hundred and fifty short words. What is implied is that one should stay away from the other extreme—that extreme where the listener is apt to remark "He must be a brilliant man for no one can understand him." When one is at this level a student of semantics is apt to take the other version and remark, "That paper was just so much blah-blah-blah."

When one considers that the "practical man" by virtue of his skill and responsibility is often indirectly responsible for the financing of the fundamental studies made by the "theoretical man" and is, therefore, entitled to benefit from the results of such work, it becomes more important that the latter should popularize his language as much as possible. Incidentally, this is not so easy to do and requires quite a bit of extra effort, but the extra effort often may pay big dividends. Let's speak their language!

WARTIME DEMANDS AND POSTWAR PLANNING CO-THEMES OF G. C. A. MEETING

The Semi-Annual Fall Meeting of the Glass Container Association was called to order by President J. Stanley Heuisler on October 26th and was again held at the Hotel Biltmore in New York.

As conditions affecting specific phases of glass container operations change, due to the war economy, and as the difficulties of wartime manufacture increase, the association meetings have become more and more varied in program and pattern of procedure.

In this instance, while the immediate problems of production, supplies, manpower and transportation consumed the greater portion of the time, the matter of postwar planning developed as a topic of major interest.

First on the program was the meeting of the members of the metal and molded closure industry. After presentation of the statistical portion of the industry, a symposium covering the Supply Outlook for Closure Materials was offered by four members of the War Production Board—each one dealing with a specific material. Mr. R. F. Sentner discussed the metal supply, the molding compound situation was covered by Mr. Grayson Wilcox, and Mr. Dan M. Gray talked on the subject of protective coatings. Following these supply reports, Mr. R. G. Peck, Jr., who has recently gone to Washington from the Aridor Cap Company, reviewed closure order M-104.

It is axiomatic, of course, that for every glass container a closure of some kind must be made. As container production increases, so must the production of closures, in direct ratio. Therefore, although exact statistics showing closure shipments are unavailable, when it is realized that container production runs into billions of units, some idea can be gained of the enormous job being accomplished not only by the glass container industry, but also by the manufacturers of the essential closure.

The statistical position of the container industry and its anticipated demand for 1943 was presented by Mr. Harry W. Kuni, the association's Washington representative.

It may be mentioned in passing that Mr. Kuni had a difficult time for some minutes in delivering his talk, since he had to compete with an unexpected air alarm test right through its blue, red, blue and "signals off" phases.

The anticipated demand and productive ability in the glass container industry has been effectively summarized in a third survey on the subject by the War Activities Committee of the Container and Closure Industries. This survey, like the two similar ones which preceded it, is designed to gauge the market for glass containers on an annual basis under the conditions and regulations that have applied during the year and to measure the industry's ability to supply it.

The estimated 1943 production of glass containers has been placed at 93.3 million gross. It should be pointed out that since this estimate is predicated on actual experiences for nine months and represents the composite judgment of the industry, it should prove reliable not

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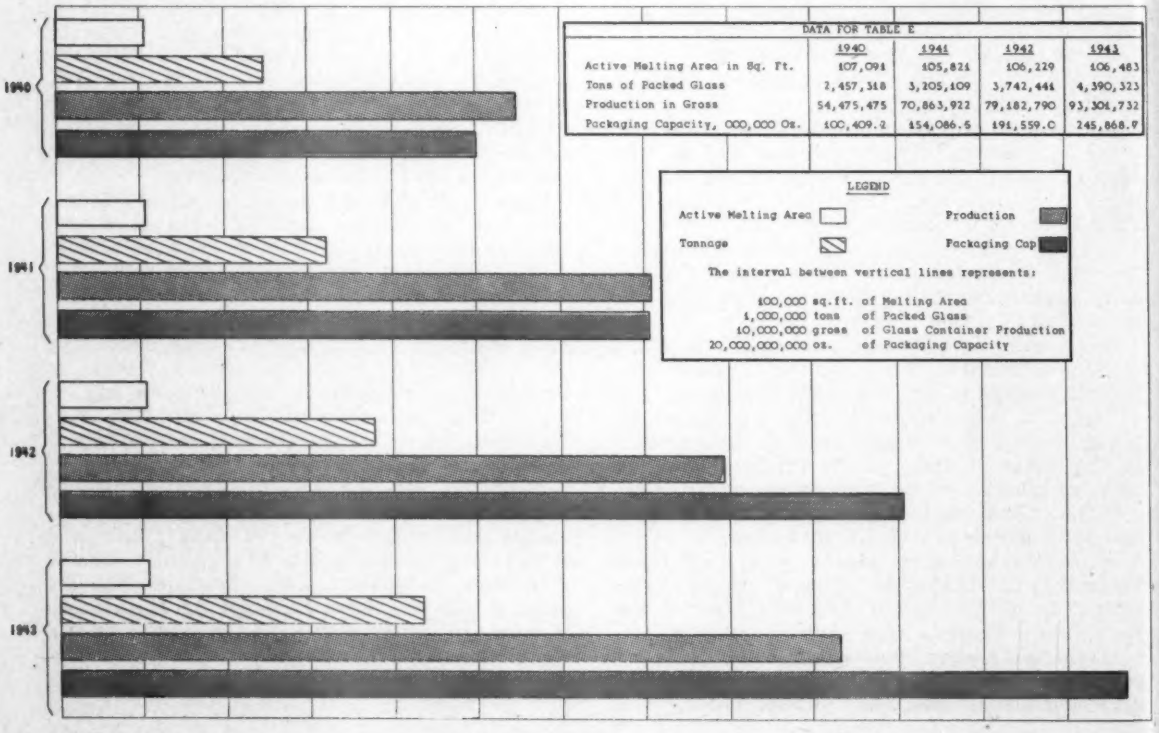
1940
1941
1942
1943
DATA FOR TABLE E
1940 1941 1942 1943
Active Melting Area in Sq. Ft. 107,094 105,824 106,229 106,483
Tons of Packed Glass 2,457,318 3,205,109 3,742,444 4,390,323
Production in Gross 54,475,475 70,863,922 79,182,790 93,304,732
Packaging Capacity, 000,000 Oz. 100,409.2 154,086.5 191,559.0 245,868.9
LEGEND
Active Melting Area
Production
Tonnage
Packaging Cap
The interval between vertical lines represents:
100,000 sq.ft. of Melting Area
1,000,000 tons of Packed Glass
10,000,000 gross of Glass Container Production
20,000,000,000 oz. of Packaging Capacity

USE OF LEAD OXIDE IN GLASSMAKING REFRACTORIES*

By A. E. BADGER, C. J. UHRMANN, A. C. OTTOSON

In recent years the prevention of cords and waves in commercial glass has received considerable study due not only to the objectionable optical effects which are produced by these inclusions in glassware but also to their deleterious influence on the mechanical strength of the ware.

The important role which surface tension plays in the rate of disappearance of cords and the production of homogeneous glass has been pointed out by several investigators.[1] An extensive series of measurements of the surface tension of various glasses has also appeared in the literature.[2]

One source of cords in glass results from the corrosion of refractories by the molten glass, which gives rise to cords having a different chemical composition than that of the main body of glass. It has been shown[1] that cords which possess a greater surface tension than that of the surrounding glass tend to have a small surface of contact; hence the diffusion process which produces homogeneous glass is hindered and the cords tend to persist. Conversely, if cords have a smaller surface tension than that of the glass which surrounds them, the cords tend to spread out and present a larger contact area, with the result that the homogenizing process is accelerated.

It has been found[2] that the addition of certain oxides to a soda-lime-silica glass produces a marked lowering of the surface tension of the resulting glass. Consideration of this fact results in the suggestion: Why not incorporate such oxides in refractories so that solution of the latter in the molten glass will produce cords of lower surface tension than that of the main body of glass? Such cords would disappear more rapidly than those resulting from corrosion of the usual refractories.

I. Use of Chromium and Vanadium Oxides

Among the oxides which were found to lower the surface tension of glass[2] are those of the alkalies, lead, boron, vanadium, and chromium. On the basis of refractoriness, chromium and vanadium oxides were first chosen from this list as suitable materials for trial. In a previous publication[3] a series of experiments was described which demonstrated the feasibility of using these oxides in glassmaking refractories as an aid to the elimination of cords. Among these experiments the following were noteworthy.

Experiment 1. Three porcelain crucibles, about 1½ inches in height, were nearly filled with powdered soda-lime-silica glass. In one of these crucibles a small fragment (roughly ⅛ inch across) of a glass containing vanadium oxide was pressed about ⅛ inch beneath the surface of the glass powder; in the second crucible a glass fragment containing chromium oxide was placed similarly, while the third crucible contained a fragment of a glass containing cobalt oxide.[4] The three crucibles were then heated together in an electric furnace at about 1100° C. for a period of one-half hour, after which they were removed and cracked open.

Since the surface tension of the vanadium-bearing glass and that of the chrome glass were considerably lower than that of the surrounding soda-lime glass, while that of the cobalt glass was greater, it would be expected that the vanadium and chrome tests would differ sharply from the cobalt test.

Figure 1 shows this assumption to be correct. The vanadium and chromium glasses have spread over the surface of the glass in a similar fashion as oil on water, while the cobalt glass exists in discreet spots embedded in the surrounding glass.

Experiment 2. As a check on the results of the first experiment, similar small crucibles were filled with soda-lime-silica glass and then fired at 1250° C. Small fragments of the vanadium glass and of the cobalt glass were then dropped on the surface of the molten glass and the heating continued for various periods, after which the crucibles were removed and cut with a diamond saw in order to observe the interior.

Figure 2 shows these results. After a five-minute period the vanadium glass of low surface tension has already spread over the surface while the cobalt glass (of high surface tension) has formed a ball which is sinking slowly through the molten glass. Continued heating of the samples permitted the cobalt glass to sink to the bottom of the crucible while the vanadium glass remained on the surface.[5]

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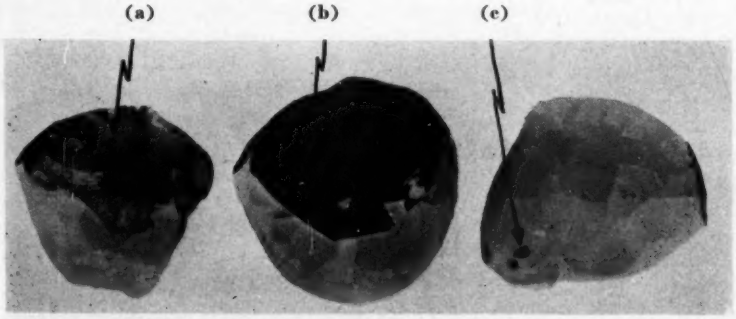

Figure 1. Contrasting surface tension effects. (a) A small fragment of glass of low surface tension containing vanadium tends to spread over the surface of soda-lime glass. (b) Similar effect of chromium glass on surface. (c) A fragment of cobalt-bearing glass of high surface tension has the tendency to ball up. (Figures (a) and (b) were photographed with ultraviolet light to show vanadium glass film by fluorescent effect.)

(a) Vanadium-bearing glass on surface.
(b) Chrome-bearing glass on surface.
(c) Cobalt-bearing glass below surface.

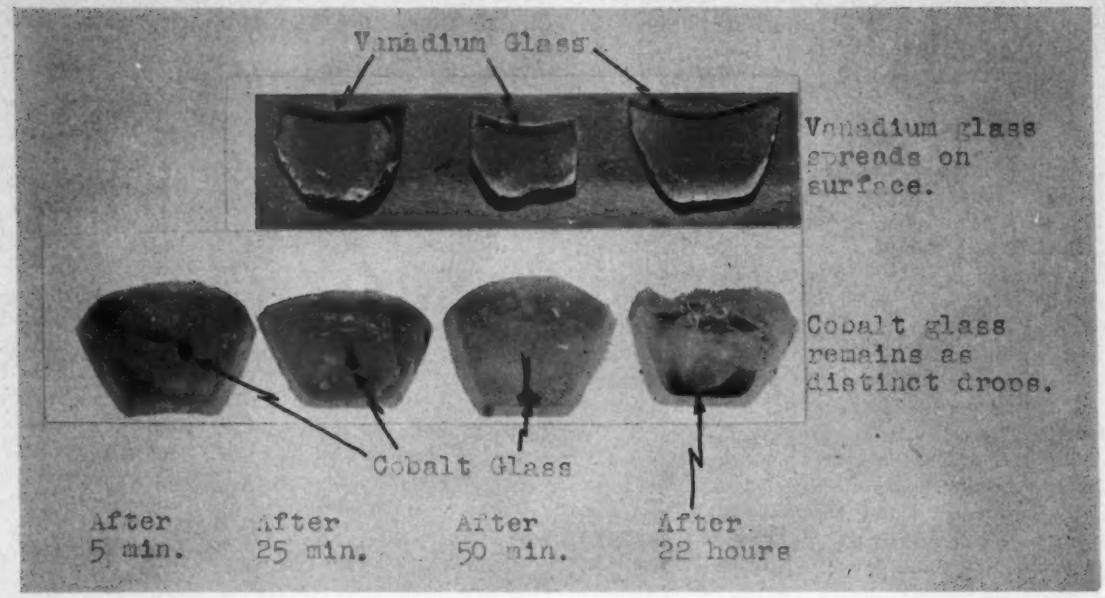

Figure 2. Contrasting surface tension effects of fragments of vanadium glass (low surface tension) and of cobalt glass (high surface tension) placed on surface of molten glass at 1250° C for various periods as noted in the figure. Vanadium glass spreads over the surface while cobalt glass remains distinct. (Vanadium glasses photographed in ultraviolet light; cobalt glasses in ordinary light.)

Experiment 3. Experiments 1 and 2 served to illustrate the pronounced effect of surface tension on the behavior of mixtures of molten glasses. Preliminary trials dealing with the elimination of cords from refractories were then made. For these experiments three test rods, about ⅜ inch square and 3 inches long, were made using 90 parts of Mississippi pot clay and 10 parts of either vanadium oxide, chromium oxide, or cobalt oxide. These refractory rods were fired and then placed in vertical positions in three platinum crucibles. Powdered soda-lime-silica glass was packed around the rods and the set of crucibles then heated at about 1250° C. for eight hours to permit corrosion of the rods by the glass. The rods were then removed and the molten glass poured in molds. The glass samples were then ground and polished.

Figure 3 shows the glasses resulting from the vanadium and cobalt tests. The glass which attacked the vanadium-bearing refractory contains diffuse clouds of vanadium glass; the glass which was in contact with the chromium-bearing refractory was colorless and quite free from cords and, therefore, is not shown; the cobalt glass cords were sharp and distinct.

The above experiments indicated the desirability of incorporating certain oxides in glassmaking refractories which would lower the surface tension of cords resulting from the corrosion of the refractories by the metal.

Obvious requirements for any oxide which may be added to glassmaking refractories for the purpose of reducing the surface tension of cords formed by corrosion are (a) that the fusion temperature of the refractory be lowered only slightly by the addition of the oxide, (b) that the rate of solution of the refractory mixture not be excessive, and (c) that the cords be colorless or nearly so.

In regard to part (a), fusion tests showed that 10% of vanadium oxide reduced the fusion temperature of Mississippi pot clay from Cone 30 (ca. 1650° C.) to Cone 27 (ca. 1605° C.). The presence of 20% chromium oxide raised the fusion temperature to Cone 31 (ca. 1690° C.). Concerning parts (b) and (c), only qualitative evidence is available at present. Glasses which were melted in refractory pots containing vanadium oxide had a light green color which indicated considerable solution of the refractory in the glass. Glasses melted in pots containing chromium oxide were nearly colorless, except for a slight fringe of green at the metal line. This fact indicated great resistance to corrosion of this refractory.

II. Use of Lead Oxide

The list of oxides which were found to lower the surface tension of soda-lime-silica glass included the alkalies, boric oxide, and lead oxide in addition to chromium and vanadium. The first two materials are such violent fluxes that no appreciable amounts could be incorporated in the refractory clay. The action of lead oxide in ceramics is usually that of a strong flux also; therefore, its use in refractories would ordinarily be regarded as detrimental. However, it may be shown that the proper use of lead oxide may produce improved performance of certain refractories used in glassmaking. Furthermore, this oxide does not possess the objectionable coloring power of chrome and vanadium and, therefore, may be used in refractories for the production of high-quality crystal glass.

III. Comparative Corrosion of Refractories Containing Lead Oxide at Furnace Melting Temperature

In order to determine the maximum amount of lead oxide which could be added safely to refractories for use in contact with molten glass at the furnace melting temperature, the following test was performed.

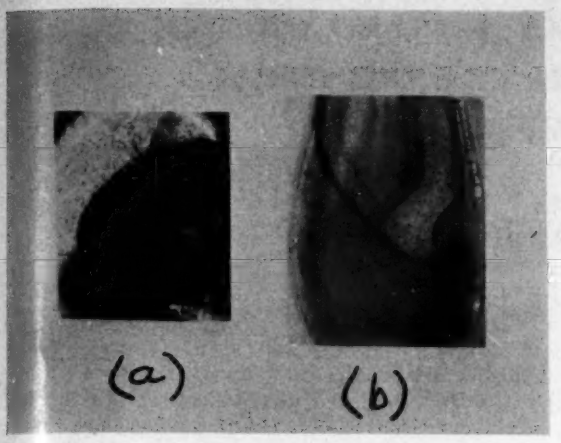

Figure 3. Glass melted in contact with refractories containing: (a) vanadium oxide, and (b) cobalt oxide. Cords of cobalt glass (high surface tension) tend to persist longer than do cords of vanadium glass which has a lower surface tension. Chromium glass was quite free from cords and is not shown. (Utraviolet light was used for photographing vanadium glass; ordinary light for cobalt glass.)

An ordinary pot clay body was pressed in a plaster-of-Paris mold in the form of a cone approximately 1¼ inches in diameter and ¾ inch high. Similar cones were pressed from bodies made by using the ordinary pot clay body with definite amounts of lead oxide, which was added either as Pb_3O_4 or as lead silicate (85% PbO). The additions of lead oxide were made in the amounts of 3, 6, 9, and 12%, respectively. After drying, the samples were fired in an electric furnace with oxidizing atmosphere for a period of 3 hours at 1425° C.

In order to compare the corrosion-resistant properties of these test samples, porcelain pots were half-filled with soda-lime-silica glass cullet and the test cones placed on top of the glass with the apex of the cone pointing downward. The pots with the best pieces were placed in an electric furnace, the temperature of which was then raised and held at 1350-1410° C. for a period of 30 hours. During this period the cones, which were floating on the molten glass, were being subjected to corrosive attack of the molten glass. At the end of the test period, the cones were removed and, after cooling, the adhering glass was ground off.

Before placing the cones in the furnace, their heights were measured with micrometer calipers. After completion of the corrosion test, the heights were again measured and the decrease in height was taken as a measure of the resistance to corrosion of the test piece. These values are listed in Table 1.

From these results the following conclusions may be drawn:

1. If Pb_3O_4 was used as a source of PbO, an addition of 3% improved the resistance to the attack of molten glass. The amount of 6% PbO could be used with slight increase in attack, while 9% PbO resulted in greatly increased attack.
2. If lead silicate (85% PbO) was used as a source of PbO, an addition up to 6% PbO resulted in improved resistance to corrosion, while 9% produced increased attack.
3. Addition of 12% PbO caused such pronounced attack that the refractory disintegrated.
4. The addition of approximately 6% PbO may be taken as the maximum amount of PbO to be introduced in the refractory, while 3% PbO addition may be more advisable. These statements refer to the attack of soda-lime-silica bottle glass at a temperature of ca. 1400° C. Increased amounts of lead oxide might be added to refractories if lower glass temperatures were used.

IV. Comparative Corrosion Test at Glass Working Temperature

As a check on the corrosion of refractories, specimens of pot clay bodies containing lead oxide from 0-10% in steps of 1% were prepared in the form of triangular pyramids about 1½″ long and ⅜″ across the base. These were fired at 1400° C. and then immersed, tip down, in soda-lime-silica glass at about 1250° C. Measurements before and after the test showed that all the bodies containing lead oxide possessed improved resistance to corrosion at the temperature of the test. The corrosion at the metal line was affected markedly. The pot clay sample without lead oxide had "necked off" and disappeared in the glass. The least attack at the metal line was shown by those specimens which contained about 5 or 6% PbO in the raw mixture.

TABLE I

Results of Corrosion Test at ca. 1375° C.

Amount of PbO Present in Original Pot Mix	Material Used as Source of PbO	Decrease in Height of Test Cone (Measure of amount of corrosion by molten glass)
0%	——	4.6 mm
3	Pb_3O_4	4.0
6	"	5.8
9	"	ca. 7 (badly corroded)
12	"	Disintegrated
3	Lead silicate	3.4
6	" "	3.4
9	" "	6.0
12	" "	Disintegrated

V. Mullite Development in Refractories

Thin sections of refractories containing varying amounts of lead oxide were made for microscopic examination. A progressive increase in mullite development was observed with increase in lead oxide, which therefore, acted as an accelerator for the growth of mullite in these bodies. It is known that mullite possesses great resistance to the attack of molten glass, and the increased resistance to corrosion which was found in bodies containing lead oxide is due in part to the better development of mullite. This increase in resistance was very marked at the metal line in some of the lead oxide bodies.

VI. Volatilization of Lead Oxide During Firing

Since lead oxide is somewhat volatile at high temperatures, it would be expected that some of this oxide would be lost during the firing of refractories containing it. In

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AN ALIGNMENT DIAGRAM BASED ON THE LYLE EQUATION FOR THE CHEMICAL DURABILITY OF GLASSES

By D. G. MERRILL
Hartford-Empire Company

The equation recently developed by Lyle[1] for the chemical attack of glasses by water is generally applicable for tests of glass containers:

$$a \log N = \log \theta - \frac{5080}{T} + c$$

in which N is the chemical attack expressed as mg. NaOH per liter of contents, θ is the time in hours, T is the absolute temperature of the test, °K(°C + 273), and a and c are experimentally determined constants.

From this equation there may be calculated the time-temperature conditions of accelerated tests when the service or storage conditions are specified, and vice versa. Similarly, for a given lot of bottles, one may calculate the chemical attack produced under almost any time-temperature conditions. For this calculation we need data from two tests made under sufficiently different conditions to obtain a significant difference in the amount of chemical attack.

Since use of the equation involving logarithms and absolute temperatures is somewhat cumbersome, the accompanying alignment diagram has been prepared to facilitate calculations. The diagram is constructed of three scales for Time, Temperature, and Attack, respectively; a grill for the "a" and "c" values of the equation; and a reference line.

To illustrate the use of this chart several examples will be given:

1. *Extrapolation from Laboratory Test Results to Service Conditions.*

To determine the service conditions equivalent to a given set of test conditions, connect the *Time in Hours* with the *Temperature °C* and extend the line to the *reference line* near the middle of the diagram. This establishes a point on the reference line such as, for instance, the point *O* shown on the diagram for a test of one hour at 120° C. A straight line connecting the point *O* with any point on the Time scale crosses the Temperature scale at a point indicating the corresponding temperature. Thus the line from the point *O* to One Year (8,760 hours) on the Time scale crosses the Temperature scale at 27° C. Therefore one hour at 120° produces chemical attack equivalent to one year at 27° C. The line from the point *O* through the Temperature scale at 94° C. intersects the Time scale at 8 hours, thus indicating the conditions for a water-bath test that would duplicate the results obtained in the One-hour-120° autoclave test.

2. *Evaluation of the constants "a" and "c".*

To determine the a and c values of a given sample, as indicated by the point L within the grill, two sets of test conditions must be used. Suppose that for a given lot of bottles when tested for one hour at 120° C. the attack is equivalent to 9 mg. NaOH per liter, and when tested for 4 hours at 95° C. the attack is 6 mg. NaOH per liter. One hour at 120° C. establishes the point *O* on the reference line, and 4 hours at 95° C. establishes the point *P*. Connect the point *O* with 9 on the Attack scale. The lines intersect within the grill at the point *L* and the a and c values can be read from the corresponding scales. The a value is 1.43 and the c value 14.3.

It is desirable that the conditions of these tests be chosen to give a good spread to the values of N, as the values of "a" and "c" will then be fixed more accurately. If additional tests are made and the lines drawn, it is unlikely that all lines will meet exactly at a point. They will instead enclose a small area and the estimated center of this area will give the best average values of "a" and "c".

Having thus determined the a and c values it is possible to estimate the amount of chemical attack for almost any set of conditions by first locating a point on the reference line corresponding to those conditions and then drawing a line from that point through the point *L* to the Attack scale. Following this procedure the attack after 5 hours at 130° is about 47 mg. NaOH per liter and after 70 days (1680 hours) at 50° is about 17 mg. NaOH per liter.

3. *Interpretation of Data.*

Within the grill the points *R*, *S* and *U*, respectively, represent the a and c values of several glasses having different chemical durability characteristics. A specification calling for a maximum attack of 9 mg. NaOH per liter for a test of one hour at 120° C. will be met by glasses *U* and *L* but not by *R* and *S*. If the specification calls for a test of 5 hours at 130° C. and an attack not to exceed 50 mg. NaOH per liter glasses *L* and *S* will be acceptable but not *R* and *U*. Thus while glass *L* is the only one that meets both test specifications, glasses *U* and *S* are each better than *L* by one method of testing.

The variation in the relative chemical durability of glasses, as determined by various tests, was demonstrated in the original article[1] but by the use of the alignment diagram this point is emphasized in a more graphic manner. Here it can be seen that glasses acceptable by one standard may be rejected by another and that unless the conditions of an accelerated test are properly chosen the results obtained may bear little relation to the service behavior of the samples tested.

[1] A. K. Lyle, "Theoretical Aspects of the Chemical Attack of Glasses by Water," Jour. Am Cer. Soc. 26 (6), p. 201-204, June, 1943. Abstracted in Glass Industry 24, (8), 347, August, 1943.

ALIGNMENT DIAGRAM
CHEMICAL ATTACK OF GLASSES BY WATER
FORMULA OF A.K.LYLE
$\alpha \log N = \log \theta - \frac{5080}{T} + C$
JOUR. AMER. CERAM. SOC. 26. 6. 201-204 (1943)
θ = TIME - HOURS
1 YR.
6 MOS.
T = TEMPERATURE - °C
N = ATTACK mg Na OH / liter
C
α
P
Q
R
S
T
U

BOTTLE PLANT INSTITUTES WARTIME EMPLOYEE TRAINING PROGRAM

Discovery that foremen as well as rank and file workers could benefit by instruction leads to participation in Training Within Industry group of the W.M.C.

By ROYDEN A. BLUNT

Vice-President & General Manager, Buck Glass Company, Baltimore, Md.

By this time, it must be apparent to everyone engaged in manufacturing in most any part of the country that the manpower problem involved is not getting better but is becoming more and more acute.

This problem covers every activity from the forests, where pulpwood is secured, through every process to a finished cardboard shipping container; from food production on the farm to the ration of a soldier or the supply of civilians, or from the sand mines through the processing in a glass furnace to the finished product. Through all of these industries and in every field the tremendous dislocaton of manpower exists.

The manpower problem has now reached the point where its solution challenges the utmost ingenuity of those of us entrusted with production in war plants and necessary plants producing for civilians. For a considerable time, this situation will become worse, for too many people do not as yet realize the seriousness nor the size of the problem involved nor the necessity for solving its complex ramifications which, under ordinary circumstances, are as surely meshed together as gears. When the figurative gears become unmeshed, as they are now, they grind together, and that is exactly what all activities throughout the country are now experiencing.

What are the solutions for these unmeshed gears which will not drive or pull our economy until they are again properly meshed? The pat answer is quite simple. Let us curtail (as has already been done) certain less essential civilian activities, in order to provide more people to perform the necessary tasks. But this isn't nearly enough. When this has been carried about as far as practicable (and it does have limits), many people who have not heretofore worked will be induced, and are being so at the present time, to go to work at a useful occupation. New workers must necessarily be unfamiliar with the work which they are to do or the processes they are to direct.

The greatest pool of help existing within the country is womanpower, both single and married, old and young. It is unreasonable to expect women who have run a household for years or girls who have not worked in a factory to go into a plant without being adequately taught and supervised on the jobs which they are to perform if they are to do them satisfactorily for the employer and also to their own satisfaction. A great many people seem to forget that it is necessary in a first class working force that employees feel that contentment which comes from understanding and knowing their jobs.

I wish to set forth here, hoping it may be of benefit to others, the experience which our company has had in the use of women in a glass factory where they have never before been employed, except for a short interval on a limited number of jobs during the war period of 1917-18. It has always been the belief of the writer that something is seriously wrong with the economy of any country which has to put a large number of its women to work industrially. The practice of using women in this plant's operations was not started until the pinch of war forced it upon us.

In March, 1943, a supervisor of women was secured and the recruitment of women for work in the Buck Glass Company plant started. This plant is surrounded by war plants, in which thousands upon thousands of women have been recruited during the past two years. Paradoxical as it may seem, restrictions were placed on the recruitment of women in an already short area in order to make the recruitment less difficult. For instance:

(1) A definite preference was given to married women, although others were not by any means excluded.

(2) Anyone riding a street-car, bus or other conveyance to work was not hired.

(3) Only those people living within walking distance were hired.

(4) Arrangements were made with the Manpower Commission's local office, so that instead of working forty-eight hours per week, forty hours per week for married women was thought of as a full week. The women claimed that with point rationing and, in many cases, children for whom food should be obtained with proper marketing methods, it was necessary to have a day a week off in which to do this.

(5) Those already employed in war plants could not be hired.

In other words, every effort was made to make it convenient for women to work in this plant. For example, if one confines his hiring in a thickly populated section where the demand isn't too great, to those who live within walking distance, the employees can work eight hours and not be away from home more than a total of eight hours and a few minutes, whereas in some outlying sections, or where a person lives on one side of a large city and works on the other side, as much as two hours are consumed in getting to or from work, making it necessary for the employee to put in a total of eleven or twelve hours to accomplish eight hours of actual work.

At the end of three months, turnover had not been bad. Approximately one hundred and twenty women had been hired to select a force of seventy-five needed. Most of these women were very tractable and easy to get along with, but for some reason they were not doing a good job. It was discovered that many of the women who were employed in the decorating and inspection departments as inspectors and packers and in making cartons, men, of course, were available for lifting, *knew* very little more about glass faults and the proper reasons for selecting and rejecting bottles after three months than they did the first week that they were there. It is astonishing how insidious such a condition as this can be in a factory. Operators and operator foremen, who share in a bonus, were quick to realize that bottles were not being properly selected. The feeling seemed to be that if bad bottles got into customers' cases and good ones in the cullet pile, what was the use of trying to make them all good? There was a distinct let-down in morale throughout the plant.

After conferences with various department heads and others, it was decided that the new employees *had not been properly instructed.* The fault did not lie in the new employee. The fault did not lie with the foremen and supervisors, who had failed to instruct them properly. The fact was that foremen for many years had not been instructing people very much. The turnover of labor had been very, very low; seldom were there more than one or two new men in the packing department over a period of a year. These men had probably served a long apprenticeship as helpers and were quite familiar with bottle faults, selecting and packing before they were put on the job. Very little supervision was necessary to make good packers of them under those conditions. Therefore, the foremen and supervisors had not had experience in training new help and particularly in training women.

For this reason, it was decided that a proper school should be established in charge of a competent person who knew glass faults and who knew the usage to which bottles generally are subjected by the customer and who would be a capable teacher. This eliminated the possibility of misunderstanding by one foreman saying one thing and another foreman saying something else, on the same subject, in different words. It also overcame timidity on the part of the new employee about asking for information, inasmuch as the employee knew that the teacher was there for the purpose of answering questions and rendering help.

In starting the classes, the curriculum was worked out in advance by the instructor, Mr. John H. Petersen, Supervisor of Service. The course of instruction consisted of twelve lessons, two lessons being given to each of the three shifts twice a week. This resulted in two hours of instruction for each person per week and kept the instructor fairly busy, inasmuch as it was necessary for him to cover the three shifts twice during the week, or to hold six sessions. The procedure was to have the middle or afternoon shift come in one hour early. They were paid for the hour in which they went to school before going on shift. The shift which came off at 4 p.m. came directly from the factory into the schoolroom. The night shift came in an hour early at 11 p.m. and received an hour's instruction before going on shift.

The first lesson consisted of a talk with the trainees, wherein the reasons for holding the school were discussed. Stress was laid on the importance of good inspection to the company and to its customers, the influence of the inspection department on costs, including overhead expense, transportation, freight, shipping, etc., the benefits that are derived from good inspection, and the benefits that the inspectors would receive from knowing thoroughly how to inspect ware easily and properly.

During the second lesson, filling and capping heads from various machines, wherein our bottles and jars are filled and otherwise processed, were demonstrated to the trainees so that they could see how a crooked bottle could cause an internal brush or spray nozzle to break off, damaging the customer's machines. Emphasis was laid on the dangerous aspects of defective ware, and on the fact that poor inspection stands between the company and satisfied customers, whereas good inspections stands between the company and dissatisfied customers.

The third lesson covered the necessity for team work between the inspectors and the operators, the men who run the machines making the bottles, and the necessity for speedy reporting of the slightest fault which the inspectors find in bottles to the operator foremen, who should see that corrective measures are taken.

(*Continued on page* 483)

CONTROVERSY ON THE CALCULATION OF DENSITY

Editor's Note: The following letters to the Editor are the result of a criticism by Dr. Samuel R. Scholes on the methods employed by Dr. Maurice L. Huggins and Dr. Kuan Han Sun in their calculation of density of glasses. The original paper by Messrs. Huggins and Sun "Calculation of Density and Optical Constants of a Glass from its Composition in Weight Percentage"* was condensed in the July 1943 issue of The Glass Industry. After publication of this summary Dr. Scholes submitted his comments to this publication. The authors of the original paper were then invited to offer their defense of their research and findings. Since it has been stated that the calculation of density of glass from its composition serves many useful purposes in the field of practical glass technology, the following letters should be of lively and useful interest to our readers. The Glass Industry invites further comment on the apparently controversial subject of the calculation of density of glasses. Dr. Scholes' comments follow:

Editor, THE GLASS INDUSTRY:

The elaborate method for calculation of density presented by Huggins and Sun in the July GLASS INDUSTRY is open to criticism on several counts:

1. It involves a set of computations as a preliminary step that is as long as the final calculation itself.

2. It is more complex than the recognized shortcomings of the additive theory should warrant.

3. Five significant figures could not be justified, when glass analyses cannot be certified to three significant figures.

4. While the method may be more interesting, and perhaps better justified by sound theory than the usual methods of calculating density, the results are not in very close agreement with observed values. That is to say, as a practical tool, the method is cumbersome and inaccurate.

The basis for this last count is a set of calculations which I have made using data for the compositions and observed densities reported by English and Turner (J. Soc. Glass Tech., 1921, p. 278). For comparison, calculations were also made, using the specific volume factors in Handbook of the Glass Industry, p. 61. The results are tabulated:

Compositions					*Density Observed*	*Density Calc. H. and S.*	*Density Calc. H.G.I.*
SiO_2	Al_2O_3	MgO	Na_2O	CaO			
73.98	7.10	—	11.66	7.10	2.4421	2.422	2.456
74.25	5.22	.06	12.72	7.91	2.4498	2.460	2.452
74.13	2.67	.09	13.54	9.74	2.4765	2.478	2.472
74.59	0.45	.30	14.22	10.38	2.4840	2.436	2.483

It is apparent that the agreement is rather better, when the simple factors from the Handbook of the Glass Industry are used.

S. R. SCHOLES,
Department of Glass Technology,
New York State College of Ceramics,
Alfred University, Alfred, N. Y.

In reply to Dr. Scholes' comments, Doctors Huggins and Sun submit the following:

Editor, THE GLASS INDUSTRY:

We are glad to have the opportunity of replying to Dr. Scholes' criticism of our work[1-4] on the calculation of glass densities. We shall consider his four points in order.

1 and 2. The complications of our methods of calculation are necessitated by the experimental data. As has previously been pointed out by others,[5-9] no method which uses a single constant per component can possibly give close agreement with the more accurate data. This is obvious if one considers a plot (Fig. 1) of the best data [8,10] on specific volumes for glasses of a two-component system, such as the Na_2O-SiO_2 system. Specific volumes computed from the specific volume factors in the Handbook of the Glass Industry would all lie on the dashed line in this figure. Volumes computed by our method would lie on the series of full lines. It is seen that the two methods give approximately the same results over a limited range; outside of that range, however, the departure from the dashed line are much larger than are those from the full lines and much larger than the probable experimental errors.

It is evident that different constants are required for different ranges of composition (SiO_2 content). Moreover, analysis[1] of the available data on this and other systems shows that the limits of the different ranges depend, not only on the percentage of SiO_2, but also on the relative amounts of other components present. Our method of calculating these limits is (we believe) theoretically sound; it gives good agreement with the experimental values; and it is as simple as possible, without destroying this good agreement.

As shown by Fig. 1 and by the results of our study[1] of all the density data on silicate glasses of known composition which we were able to find in the literature, the recognized shortcomings of the simple additive theory (on which the specific volume factors used by Dr. Scholes are based) are largely eliminated by our more complicated treatment. We insist that the added complication—the calculation of N_{Si} (by simple multiplication, addition and division) to determine which set of volume constants to use—is amply justified by the improved agreement so obtained.

3. We give our volume constants to three significant figures only, except in the case of the constants for SiO_2, where four are given. This is justified by the accuracy of the data in the Na_2O-SiO_2 system (see Fig. 1). Morey and Merwin give their density values for glasses in this system to four figures; Young, Glaze, Faick and Finn give theirs to five figures; both sets of workers give composition values to four figures.

The number of figures in our s_M values is (and should be) determined by the number of figures given for the atomic weights in the International Atomic Weight Table, since s_M is defined as the ratio of the number of

*Journal of American Ceramic Society, 26, 1, 4-11, 1943.

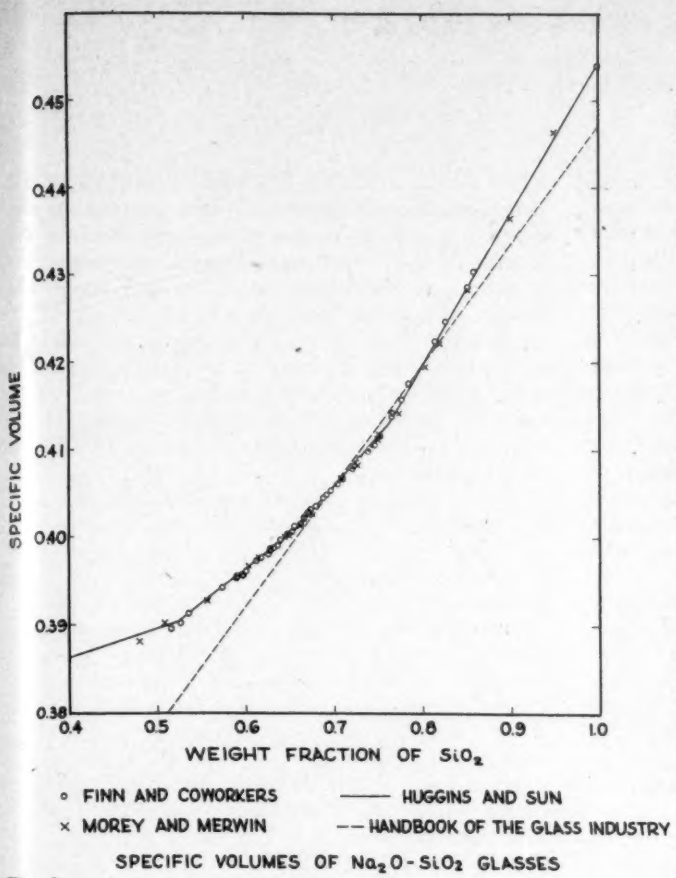


Fig. 1.

oxygen atoms represented in the formula of a component to the molecular weight of that component.

4. We disagree with Dr. Scholes' statement that the results of density calculations by our method "are not in very close agreement with observed values." Our published graphs,[1] including points for several hundred glasses, show the agreement in most cases to be as good as the probable error of the experimental points, as indicated by the scattering of the experimental values for glasses of practically the same composition. Surely this extensive comparison with the observed data should bear more weight than Dr. Scholes' statement, based on data for only four glasses, all quite similar in composition.

Table I gives the published[11] composition and density data for these four glasses, with the results of our calculations by our two procedures and by the procedure preferred by Dr. Scholes. Several remarks concerning this table are pertinent:

(a) Dr. Scholes makes no reference to the iron oxide content of these glasses. Presumably he neglects it in his computations, since the Handbook factors do not include any for Fe_2O_3. Actually, this neglect has only a minor effect (0.001 to 0.003) on the calculated density values, but omission of any mention of these facts is misleading.

(b) Dr. Scholes apparently makes significant errors in his computation by our method of the densities of the first and last glasses listed.

(c) Although Dr. Scholes does not state whether he used our Procedure No. 1 (Method A) or Procedure No. 2 (Method B), comparison of our table with his indicates that he probably used the former. He should, however, have used the latter, which we definitely recommended for the glasses studied at Sheffield.

(d) The average agreement between the experimental values and those computed by our method (B) is the same as that obtained using his method. (Corresponding values in the last two columns are nearly the same.) It may be noted that the silica contents of the glasses he has chosen are all within a very limited range, in the region in which our method and his give about equally good agreement (cf. Fig. 1). If he had chosen glasses covering a much wider range of silica content, he would have found that our method gives considerably greater accuracy, on the average, than his.

(e) Some of the discrepancy between the experimental values and those computed (either by our method or Dr. Scholes') may be due to the Al_2O_3 content of three of these glasses. As English and Turner[11] have pointed out, the effect of Al_2O_3 on the specific volume is not as regular as in the case of other common components. We have also noted this and discussed a possible reason for it.[1]

(f) The differences between observed and calculated values are only of the order to be expected as a result of inaccuracies in the analytical data. That these are inaccurate is shown by the fact that the sums of the percentages listed differ from 100 by amounts ranging from —0.06 to +0.26. No computational method can

(*Continued on page* 485)

TABLE I

Percentage Composition						*Density Observed*	*Density Calculated*		
							Huggins and Sun		*Handbook Glass Industry*
SiO_2	Al_2O_3	MgO	Na_2O	CaO	Fe_2O_3		*Method A*	*Method B*	
73.98	7.10	tr.	11.66	7.10	0.10	2.4421	2.457	2.449	2.450
74.25	5.23	0.06	12.72	7.91	0.07	2.4498	2.459	2.451	2.452
74.13	2.67	0.09	13.54	9.74	0.09	2.4655	2.477	2.470	2.472
74.59	0.45	0.30	14.22	10.38	0.21	2.4840	2.487	2.480	2.484
Average deviations from observed values							0.010	0.004	0.004

QUALITY CONTROL

by FRANK W. PRESTON

No doubt many readers of The Glass Industry will have read the article on "Quality Control" in the October, 1943, issue of Fortune. It is there illustrated with reference more particularly to ball-bearings, one of the products of industry which is made to extraordinary precision.

This precision is necessary in certain applications of ball-bearings, and a fairly high precision is necessary in almost all applications. It is by no means a simple matter to obtain it, and variability of the product impairs or destroys its commercial utility.

These factors do not operate in the same degree in the manufacture of most kinds of glassware, but none the less the question has no doubt arisen in the minds of our readers as to how far it may shortly become desirable to install Quality Control techniques in plants manufacturing bottles or other glassware.

The term "Quality Control" is here used in its technical sense, which cannot be defined in very simple words. Most industrial products are not "under control" in this sense; in fact they are definitely "out of control." They vary in a somewhat unpredictable manner, for reasons other than pure chance: these reasons may include variations of temperature, mechnical adjustments, chemical composition, and so on, which can be discovered or "assigned" and corrected.

The need for such investigation and correction may be disputed, since it does not follow that a product which is "out of control," in this technical sense, is commercially unsatisfactory. If that were the case, then practically everything made by industry up to the last few years would have been commercially unsatisfactory, and clearly this is not the case. Most of the "products," from paleolithic flint arrow heads to the French 75's in the last war and Harris' block busters in this have been worthy of respect, by those on the receiving end, independently of quality control techniques or even total ignorance of the basic principles thereof; and so have the products of peace time industry.

But this does not mean that quality-control is unnecessary, or that it is undesirable except in a few instances of the most meticulous products. It seems probable that a factory operating "under control" may, even with products of a somewhat commonplace character, prove more profitable than one operating "out of control," and packing normally 95% of its product with the comforting knowledge that the "margins of safety" are ample, the "tolerances" wide, and the likelihood of trouble remote.

For, with such a factory, serious trouble may appear suddenly, and without explanation, so that a serious economic setback is incurred. Such a setback is not outside the experience of most members of the glass industry. But there is the further disadvantage, and one not so immediately obvious, that it costs money day in and day out to maintain excessive margins of safety.

Quality control cannot eliminate all the troubles of a glass man, but it is conceivable that it can eliminate some of them; and since he has plenty, elimination of some of them would not necessarily make life monotonous.

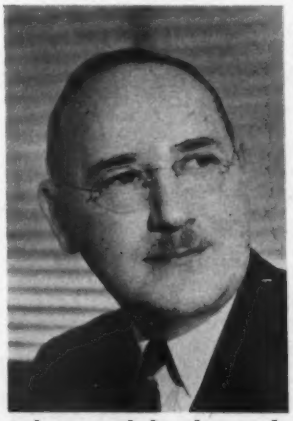
The Standard Testing Procedure Committee of the Glass Container Association has been interested in this subject for some years past, since it has been proved conclusively that bottles are frequently, and presumably normally "out of control" in a technical sense. The product, that is the bottle, is perfectly sound for its intended purposes, but the possibility remains that the soundness is being purchased at too high a price. The success to date of the lightweighting "program" proves that was certainly the case in the past; and there is no evidence that the future may not prove that it is the case in the present.

Present testing procedures are a big advance on those of a decade ago. They serve fairly well, perhaps very well indeed, as a warranty of the product that is *sold*. They do not serve nearly so well to provide the basic data for factory operation, or even for bottle design.

It may therefore be well worth-while to examine the merits of applying quality control techniques to testing procedures, and this point is already under investigation. It seems probable that no great progress will be made till after the war, on account of lack of personnel to investigate and apply it. But since the matter is no longer circumscribed in technical circles, but has been brought vividly before the general public, it may be worth-while recording that the glass industry is aware of its potential importance and is doing something about it.

NORTH WRIGHT NEW ASSISTANT TO G. P. MacNICHOL, JR., AT L-O-F

North A. Wright has just been appointed assistant to G. P. MacNichol, Jr., vice president in charge of sales of Libbey-Owens-Ford Glass Company, according to a company announcement.



Mr. Wright came to L-O-F in 1933 as advertising manager, later becoming sales promotional manager. Since the start of the present war, he has spent most of his time in Washington maintaining contacts with various government agencies because of the company's war production activities. He will continue his Washington work in addition to his new duties.

Mr. Wright is widely known in the automotive industry and the glass trade generally. He is a member of the board of directors of Producers Council, an organization of manufacturers of nationally known products for the construction field.

Mr. Wright attended the University of Kansas and served in the first World War as a flyer in the Marine Corps.

Research Digest

Practical Interpretations of Glass Technology

The Problem of Cords in Glass

In the April, 1943, issue of the Journal of the Society of Glass Technology, Professor W. E. S. Turner has presented an excellent review of the various phases connected with the problem of cords in glass. In the general introduction, Turner states that "The problem of cords is really the old problem of homogeneity" and goes on to show that much of the old mystery connected with the problem has been removed by systematic investigations on the "how - why and what" when glass is melted or remelted. It is also shown that in nature itself heterogeneity is the rule rather than the exception and when one considers the viscous nature of glass it is not to be wondered that cords should be a natural defect.

In his list of methods which are used to detect inhomogeneities, Turner lists the following: 1—Visual methods such as the naked eye, shadow or contrasting field and polariscopic methods; 2—Physical methods, such as refraction index, density (particularly density differences by centrifuge) and mechanical strength methods; 3—Chemical methods such as the action of steam and water, weathering or the use of dye stuffs or silver stains.

Cords and inhomogeneities can be related usefully to four physical properties, namely: Relation to Mutual Solubility, Relation to Surface Tension, Relation to the Viscosity and Relation to Density. Of the four properties, surface tension and density seem to play the greatest roles. In the glass melting process, cords may originate as follows: 1—Incomplete melting of either batch material or solid material from the refractories. Stones formed in this manner slowly dissolve in the melt, giving rise to cords. 2—Incomplete diffusion through excessive loads, unsuitable temperature distribution in the furnace or inadequate refining temperature, time or surface. 3—Through corrosion of refractory materials which gives rise to large amounts of viscous high alumina bearing glasses. 4—By differential volatilization of one or more components of the glass such as boric oxide, lead oxide, potash and soda. 5—Through devitrification or devitrification followed by re-solution of crystals.

There is no real cure for cords short of remelting the glass. Prevention is not only preferable, but is far easier to effect than a cure. Turner lists the following methods of prevention: (a) Rigid control over constancy of composition both of raw materials, of cullet and of ultimate glass composition. (b) Thorough mixing and preventing of unmixing or segregation. (c) Use of high corrosion resistant refractories. (d) Proper furnace design and prevention of stagnant areas. (e) Quick working out of the glass, proper distribution to machines and elimination of excessive pulls. (f) Appropriate temperature distribution and constancy of temperature. (g) Constant glass level. (h) Prevention of devitrification through insulation of feeder channels or drawing chambers.

Turner indicates that stirring devices for use in the forehearth may increase homogeneity, but then efficiency cannot be expected to be so high as the stirring during the production of optical glass.

Spectrophotometric Investigations on Iron-Containing Soda-Lime-Silica Glasses. The Effect of Arsenic and Antimony Oxides.

Wang and Turner, continuing their spectrophotometric studies, report in the April, 1943, issue of the Journal of the Society of Glass Technology the results that they obtained on the effect of arsenic and antimony in iron-containing soda-lime-silica glasses. This report is Part II of an extended series of spectrophotometric studies.

Glasses, based on that of parent composition 75 per cent SiO_2, 10 CaO and 15 Na_2O, containing varying amounts of iron oxide and of arsenic oxide or antimony oxide, were melted at 1400° C. for six hours in platinum in a gas-fired furnace after presintering of the mixture at 750° C. The amount or iron oxide added varied from 0.05 per cent to 0.25 per cent, when expressed as Fe_2O_3, and that of arsenic or antimony from 0.05 per cent up to about 3 per cent expressed as As_2O_3 or Sb_2O_3.

Spectrophotometric measurements using the recently described technique (Jour. Soc. Glass Tech., December, 1942 or Research Digest, September, 1943) were then made and the influence of the arsenic or antimony determined by an analysis of the specific extinction coefficients so measured.

The effect of these materials as decolorizers appeared to be two-fold. First, the oxidizing effect shifted the ferrous-ferric equilibrium towards the ferric state, and second, their presence caused some of the iron to form a colorless product.

The authors again emphasize the fact that, in the study of decolorization, generalizations should not be made from results based on glasses containing substantially higher concentrations either of iron oxide or of the decolorizers employed than those at which decolorizing is attainable. (This philosophy could well be adapted to other phases of glass technology. Many of our present beliefs are based upon information obtained at "high levels" and extrapolated to "lower levels".)

Identification of Lead in Glass

Feigl and Braile, reporting on the use of sodium rhodizonate in the analysis of mineral products and alloys in spot reactions (The Chemist Analyst, August, 1943), also describe its use in the identification of lead in glass. When as much as 30 per cent of lead is present, it can be identified immediately by testing about 1 mg. of the pulverized glass on a spot plate with the sodium rhodizonate and buffer solutions. In this case the powder becomes red almost at once. A glass containing as little as 0.3 per cent shows a distinct reaction when several milligrams of the pulverized speci-

(*Continued on page* 488)

INVENTIONS AND INVENTORS

A Summary of United States Patents of Interest to the Glass Industry Issued During September

Compositions

Frederick W. Adams of the Pittsburgh Plate Glass Co. has been granted another patent for a process concerned with the elimination of gases from molten glass. He had first proposed in patent 2,274,643 to sweep tiny bubbles from the glass during fining by first injecting carbon dioxide. While this was said to remove effectively such gas bubbles as those caused by water vapor, an undesirable brownish tint resulted, which was then removed by further purging with air or other gas containing oxygen. In Adams' present patent 2,330,324 it is reported that the result of the oxidation was a bluish tint which was also objectionable. The solution suggested in this patent is to follow the carbon dioxide treatment with an oxygen treatment for only a portion of the glass, after which this portion is mixed with the remainder which has not been treated with the oxidizing gas.

Furnaces

A means of carrying out the foregoing ideas for charging gases is described in 2,330,343 granted to John G. Frantz, also of the Pittsburgh Plate Glass Co. As shown by Fig. 1, he provided a stirring head which allows the glass to be simultaneously agitated while gases are being bubbled through holes in the bottom of the stirrer. Gases circulate through conduits 42 to 44 and enter the glass through openings 53.

In the January 1942 issue of GLASS INDUSTRY, two of L. S. Longnecker's patents for glass melting furnaces were discussed. These two patents, as well as 2,328,917 which has just been issued, are concerned with melting furnaces having a single long continuous port on each side of the furnace, designed to give a ribbon-like flame over the entire melting surface. This latest patent covers details of the regenerator uptakes and the ports which have a knuckled suspended roof.

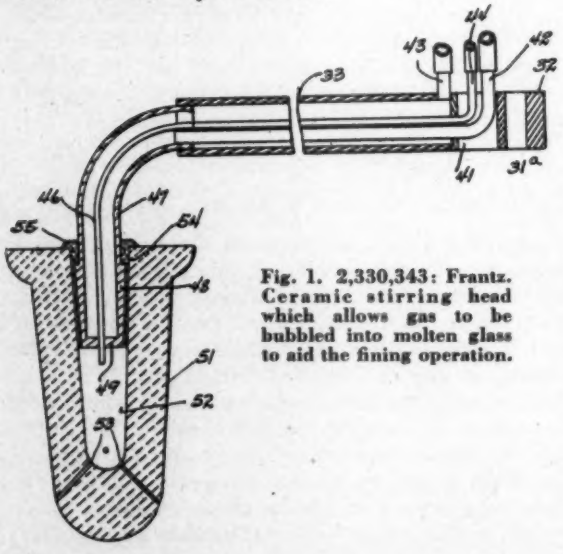


Fig. 1. 2,330,343: Frantz. Ceramic stirring head which allows gas to be bubbled into molten glass to aid the fining operation.

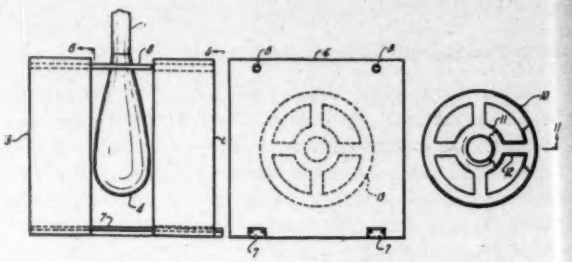


Fig. 2. 2,329,136: Poglein. An inflated blank is used as the charge in a pressing operation for forming various items of hollow ware. In this case the product is the wheel shaped tubed article at the right.

Feeing, Forming and Shaping

Patent 2,328,662 granted to G. E. Meredith and C. W. Davis (The Mantle Lamp Co. of America, Chicago) pertains to apparatus for handling glass articles in connection with their molding by pressing and blowing, so that they may be transferred from one mold to another without employing split transfer rings. The invention consists of a transfer ring with two portions which may be moved relative to each other to expand the inner portion relative to the outer portion to release the glass article upon its completion, and to contract the inner portion to put it into such position as will allow the ring to engage the glass article and to sustain it for carrying.

Fig. 2 illustrates a new hand molding principle for hollow glass articles, invented by Louis Poglein of Jeanette, Pa. (2,329,136; McKee Glass Co.). First a hollow parison is blown, then it is inserted between the two halves of a mold, which in closing together sever the charge and form the final article against the pressure of the air included within the parison. As illustrated, the article formed is a wheel-shaped piece with hollow sections. By substituting neon gas for air and by providing the electrical terminals, suitable glass shapes for lighting may be made in this single molding operation.

Patent 2,328,873 describes a gob fed rotary forming machine for containers. It was developed by James M. Young of St. Louis. It performs all of the operations of forming the blanks, transferring them, blowing to final form and discharging the product, while in continuous motion.

The Kelly Foundry & Machine Co. of Elkins, W. Va., received patent 2,329,012 through assignment by F. W. Stewart, M. J. Kelly and A. J. Reed. It relates to a paste mold machine with molds mounted on a rotary table, and with blow pipes removable either mechanically or by hand. One feature is the provision of a simplified self-contained compressed air system for operating the blow pipe chuck, opening and closing the molds and doing the blowing. The blow pipe chuck is entirely free of any mechanical connection with the air supply, and there is therefore no problem of avoiding damage to connections when it is raised or lowered.

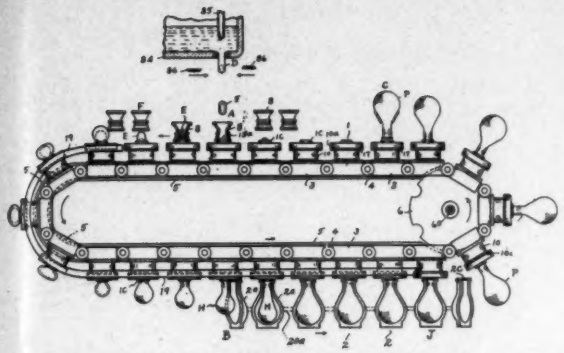


Fig. 3. 2,329,146: Teichmann. A bulb machine in which the neck rings, made in two parts, are held together by electro-magnetic force until they reach the position where the ring is split for removal of the product.

Henry F. Teichmann's latest patent is 2,329,146 for a chain type molding machine for making such ware as lamp bulbs. Neck molds made in two separable parts mounted on a chain conveyor receive the gobs, give them the initial blow and then advance to positions where they meet blow molds for the final shaping. The neck molds rotate during blowing. The claims are in part directed to the electro-magnetic method of holding the halves of the neck mold together, and of separating them. The machine is illustrated in Fig. 3.

In the manufacture of tubular glass by flowing molten glass over a ceramic mandrel the wall thickness of the tube is governed by the temperature and condition of the glass, but compensation may be provided by varying the speed of the mandrel. Variable speed and other features are built into the mandrel driving apparatus of patent 2,329,164 assigned to Sylvania Electric Products, Inc., by Wm. P. Stuckert of Marblehead, and H. H. Snyder of Lynn, Mass.

Charles M. Biggs of Lancaster, N. Y., assigned to Hazel-Atlas Glass Co. his patent 2,330,668 for means of instantly stopping a forming machine (of the type in which a slide carries a mold bottom into position to cooperate with the blow mold), if for any reason one of the mold bottoms is not properly retracted. Such failure operates an electric switch which shuts off the motor driving the table.

Patent 2,330,363 assigned by Anthony Kaziska of Port Allegany, Pa., to Pittsburgh Corning Corp., covers a method of assembling the halves of glass blocks, so there will be a slot to allow the article to be used as a coin bank.

Miscellaneous Processes

Harry R. Kiehl, of Corning Glass Works, describes a tempering procedure in 2,329,057, which would give a glass tumbler greatest strength where it is needed most, near the edge. His procedure gives a tempered rim or band at the open end and this merges directly into the temper-free body of the article without appreciable tensile stress at the surface of the ware, which would render the article unstable. He first anneals the tumbler, then applies flame to the top band and finally cools it by air blast.

Other Corning Glass acquisitions include Henry H. Blau's patents 2,330,193 and 2,330,194. The first concerns the manufacture of a sealed-in head lamp made by staining a cover glass yellow or red and then sealing its edge by fusion to the edge of a glass reflector. In prior processes the stain became discolored on the rim of the cover glass during the fusing operation, due to overheating. Blau prevents this by choice of composition and staining temperature. A typical stain is 54 per cent ochre, 30 per cent barium carbonate, 5 per cent copper sulfide and 11 per cent silver sulfide. This is sprayed onto the cover glass which is then fired to 700° C. for about ten minutes. This temperature is intentionally chosen as being about 100° C. higher than that which the edge of the cover will reach during sealing. Before sealing, the stain residues are removed by immersion in hydrochloric acid which attacks the carbonate and thus readily removes the excess staining materials. Blau's second patent covers a reflecting optical system for use in reflecting a beam of light back to the observer.

Patent 2,330,072 issued to George Meister, Newark, N. J., of Westinghouse Electric and Manufacturing Co., tells how he produces seals between fused quartz and borosilicate glass heated at a temperature high enough to completely degasify the latter. He has obtained broad claims.

Chas. P. Marsden, Jr., of Bloomfield, N. J., has added to the art of frosting lamp bulbs without acid etching, by using ortho-silicic acid esters "preferably such as methyl, methyl-ethyl and ethyl esters." His preference as given in patent 2,329,632 is tetra-ethyl silicate. Typically he would coat the inside of the bulb with the following water-free mix, pour out the excess and then dry to harden the coating:

20 cc tetryl-ethyl silicate
20 cc acetone
3 drops C.P. HCl (about 35 per cent)

The machine described in patent 2,329,873, assigned by Lawrence W. Buzby, of Millville, N. J., to Kimble Glass Co., is intended for separating glass vials of varying lengths.

Sheet and Plate Glass

Fig. 4 shows the sheet glass bending frame described in patent 2,330,349 assigned to Pittsburgh Plate Glass Co. by Henry J. Galey, of Tarentum, Pa. This view shows the end of the frame. One or more sheets, 21, are laid on the two curved plates or wings, 17, so that the sheet edges are hold by stops or flanges, 20, on the

(*Continued on page* 487)

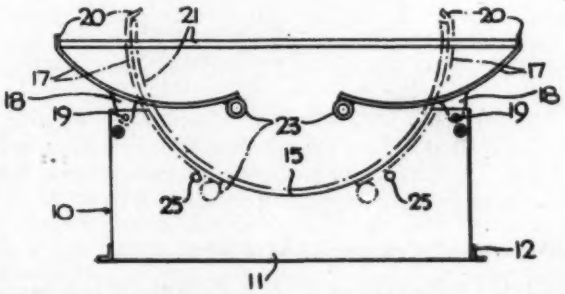


Fig. 4. 2,330,349: Galey. In this sheet bending frame weights 23, on the pivoted supporting wings 17, exert pressure urging the sheets to bend to a form governed by the final position of the wings shown in broken lines.

(*Continued from page* 467)

order to determine the extent of this loss, a series of bars was made with the approximate dimensions: length, 4 inches; width, 1 inch; thickness 3/16 inch. These bars were fired at 1425° C. in an electric furnace for a period of about 3 hours, after which they were allowed to cool in the furnace and then analyzed chemically for PbO. The amounts of PbO present in the original mix and the amounts found after firing are listed in Table II.

TABLE II

Loss of Lead Oxide During Firing

Amount PbO Present in Original Mix	Material Used for Addition of PbO	Amount PbO Found in Body After Firing
3	Pb_3O_4	2.2
6	"	5.1
9	"	8.7
3	Lead silicate (85% PbO)	2.5
6	" " "	5.5
9	" " "	9.0

This table shows that less PbO was lost when lead silicate was used as a source of lead oxide, as was expected. The data given in this table apply only to this set of trials; if larger test pieces are used, as would be the case in commercial practice, a lower loss would be expected, also a longer or higher fire would be expected to result in an increase in volatilization loss.

VII. Temperature Limits for Use of Refractories Containing Lead Oxide

It might be thought that lead oxide in refractories would cause sufficient flow under load so that glass-melting refractories might squat or otherwise deform during use in the furnace. In order to test the flowing characteristics of refractories, test bars were made about 4 inches long, 1 inch wide, and 3/16 inch thick. These bars were then fired at 1400° C., after which they were suspended in an electric furnace on blocks about 3 inches apart with the wide faces of the test pieces in a horizontal position.

The test pieces had been made with lead oxide contents of 3, 6, and 9% PbO which had been added as Pb_3O_4 in one set of samples and as lead silicate in another. The temperature of the furnace was held at 1400° C. for about two hours and the furnace door then removed in order to observe whether any sagging of the test pieces had occurred. No sagging was evident. This procedure was repeated with a furnace temperature of 1450° C. and marked sagging was observed in the body containing 9% PbO.

Bodies made with 6% PbO, either in the form of Pb_3O_4 or lead silicate, did not show evidence of sagging and the conclusion may be drawn that these refractories may have practical application up to about 1450° C.

VIII. Other Properties of Bodies

Bodies containing up to 9% PbO which had been fired at 1400° C. were used in tests on *apparent porosity* and *bulk specific gravity* with the results as given in Table III.

TABLE III

Density and Porosity Tests

Amount PbO Present in Original Mix	Material used to Furnish PbO	Apparent Porosity	Bulk Specific Gravity
0	Pb_3O_4	22.6%	2.01
3	"	22.3	2.04
6	"	22.2	2.07
9	"	12.2	2.26
3	Lead silicate (85% PbO)	22.7	2.01
6	" " "	21.2	2.05
9	" " "	12.1	2.12

The small change in the above values, up to 6% PbO, shows that this amount of lead oxide does not cause distortion in the body. With 9% PbO, sufficient glassy material is present in the refractory to produce the decrease in porosity and rise in bulk specific gravity as noted in the table.

IX. Other Possibilities of Introducing Lead Oxide in Glassmaking Refractories

The method of introducing lead oxide which was used in the foregoing experiments consisted in mixing lead oxide, or another compound of lead, with an ordinary pot clay mixture. However, it may be possible to produce a similar effect by other means, as follows:

1. The ordinary refractory may comprise the outer part of the melting pot or tank block and an inner layer of special refractory containing lead oxide then cast or otherwise formed on the interior. Thus, the cost of the refractory might be decreased and any danger of squatting further reduced.
2. In the melting of optical glass only a relatively thin resistant layer on the pot interior is required. It may be possible to produce this layer by painting a wash of lead oxide or another compound of lead on the interior and then firing the pot so that proper reaction between the refractory and lead oxide will occur.

X. Summary of Factory Tests

In order to obtain a practical test on the use of lead oxide in refractories, eight gathering rings have been prepared and used in regular production.

Gathering rings are subjected to the intense corrosive action of raw batch as well as to sudden temperature changes. Also, any cords produced by contact with the metal have a good chance of showing up on the ware. The test rings were made with 5% lead oxide and lasted for 16 melts on the average. These rings did not show the severe pitting which is usually exhibited by rings, the corrosion being more even.

These factory-scale experiments are to be continued. From present indications, the use of a small amount of lead oxide, as 3% perhaps, may be worth while from an economic standpoint in special refractories, as gathering rings, feeder parts, flow spouts, etc.

XI. Possibility of Using Lead Oxide in Silica Refractories

Since moderate amounts of lead oxide were found to

(*Continued on page* 486)

(*Continued from page* 464)

only as a guide for performance in 1943, but also as a means of projecting next year's volume.

It is interesting to note that in a comparison with previous estimates such as this, the industry has in each instance raised its sights. Hence, the present 1943 expectation of 93,301,732 gross of containers exceeds the last estimate made in March of this year by somewhat over 4.5 million gross.

In endeavoring to visualize potential 1944 production, it is felt by the container industry that 1943 performance enables, at least, a theoretical projection of 1944 volume.

Basing a theoretical estimate for 1944 on the reasonable assumption that 1943 *operating* conditions can be maintained, it is believed that production can be substantially increased in excess of 100 million gross in 1944 if unforeseen natural impediments such as fire and flood are not encountered as they were in 1943 and if improvements can be obtained in equipment, supplies, fuel and manpower—all of which contributed to curtailment of total volume this year.

In reviewing the achievements of the glass container industry and in meeting the packaging demands of the nation at war, it is interesting to note one fact which perhaps is not as apparent as the more common indices of tonnage and grossage. This factor is the rapid increase in average packaging capacity. When it is considered that the change in packaging capacity of glass containers is 144.9 per cent in 1943 as compared with 1940, the tremendous importance of this development in the industry's program can be easily understood.

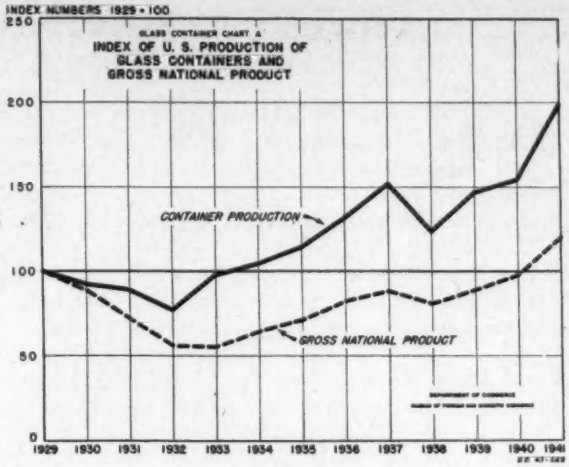
Despite the importance of this one phase of the container industry's attempt to meet constantly increasing demands for glass, the other basic factors of active melting area, glass tonnage and production in gross should not be overlooked.

A clear picture of the gains made in all of these factors can be obtained by a study of the chart which graphically illustrates that, while active melting area has not increased, the industry has vastly expanded production in terms of glass tonnage, gross volume and the aforementioned packaging capacity of all ware.

As a slight change of pace, following the discussions on the present and immediate activities of the container industry, Mr. C. R. Stevenson delivered a brief talk, "An Introduction to Postwar Thinking," which was followed by an interesting and analytical address on the subject by Mr. E. J. Detgen, Chief of the Specialties Unit, Bureau of Foreign and Domestic Commerce of the Department of Commerce.

In his address, "A Key to Postwar Planning in Glass Container Industry," Mr. Detgen broadly outlined the present efforts of the Department of Commerce to study and evaluate business possibilities after the war, and pointed out that the initial result of this activity is incorporated in the Department's recent publication "Markets After the War—An Approach to Their Analysis." He urged that all the assembled glassmen secure copies of this book, since it is believed to "provide businessmen with a common goal of postwar opportunity."

Expanding his thoughts into the field of employment



after the war, Mr. Detgen explained the distinction between the terms "gross national product" and "gross national income," the former being used as the basis for calculating the productive requirements of business in order to obtain the prosperity which is hoped for after the war.

Speaking specifically of glass containers, Mr. Detgen stated that "glass containers lend themselves particularly well to this type of statistical approach, because over a period of years, glass container production has followed very closely the trends in our gross national product." The above chart shows this inclination of glass container production to follow the gross national product, that is, the total output of all goods and services.

In referring to the challenge presented to glassmen in the contemplated postwar business battle, Mr. Detgen made an excellent point in stating that the glass container industry had a dual responsibility, since it was in a sense a "captive group." By this was meant that few ultimate consumers buy glass containers and that it is what the containers carry to market that makes the container industry's market, hence market-wise the industry is captive.

Elaborating on this point, Mr. Detgen strongly urged that glassmen "needle" their customers to plan for postwar markets and stated that there is "nothing inevitable about the glass container business—it must be fought for."

Further attention was focused on postwar planning by Mr. Victor L. Hall, G.C.A. Business Manager, in his address, "Some Basic Considerations for Industry Development in the Postwar Period." Mr. Hall presented certain statistical data covering the estimated production required to obtain the necessary employment as the industry share in the projected postwar planning. He also enumerated some of the advantages which the industry would have, among these the potential market in the food packaging industries.

Toward the close of the first day's session, a very brief report was made on the litigation involving the Association by Mr. Thomas M. Harmon, of the legal staff. Nothing definite, of course, could be stated, since the case is now awaiting hearing by the United States

(*Continued on page* 482)

CURRENT STATISTICAL POSITION OF GLASS

Activity in the glass industry during August showed a good increase over the previous month in production, payrolls and employment. According to the August Production Index, output during August, 1943, was $47,000,000 as compared to $39,000,000 in August, 1942. This brought the eight months' cumulative total to $348,000,000 which is a 20 per cent increase over the same period of last year.

Plate glass production during September totalled 7,313,447 sq. ft. according to the Plate Glass Manufacturers of America. This was an increase of 4 per cent over the previous month's total and 54 per cent above the volume reported for September, 1943. During the first 9 months of this year plate glass output amounted to 52,885,789 sq. ft. as compared to 47,712,535 sq. ft. produced in the same period last year—an increase of 10 per cent.

Window glass: THE GLASS INDUSTRY was informed, as this issue was ready for press, that window glass production figures regularly supplied by the association for publication would be unavailable. It is hoped that there will be an early resumption of publication of this data and THE GLASS INDUSTRY is directing its efforts to this end.

Glass container production during September totalled 7,588,897 gross, as reported by the Glass Container Association of America. This represented a decline of 8 per cent from the previous month and a slight gain over September, 1942. During the first 9 months of 1943 the total was 68,637,856 gross, an increase of 14 per cent as compared to the same period in 1942.

Shipments of glass containers during September increased approximately 10 per cent from the September, 1942, total, and decreased slightly from last month. However, the cumulative total for the January-September period of 1943 increased to 70,445,328 gross, or 18 per cent greater than in January-September of 1942.

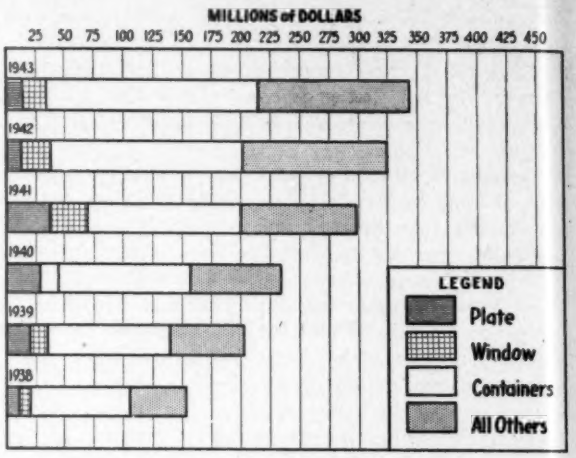
The outstanding gains over September, 1942, were: wide mouth food containers—30 per cent; pressed food ware—25 per cent; medicinal and toilet ware—44 per cent; and general purpose ware—61 per cent. A decrease was reported in beer bottles—38 per cent; liquor ware—31 per cent; milk bottles—7 per cent; fruit jars—15 per cent and jelly glasses—86 per cent. The major increases over 1942 on the 9 months' basis were: narrow neck food containers—28 per cent; wide mouth food containers—35 per cent; and general purpose ware—56 per cent.

Inventories of glass containers for September totalled 4,881,607 gross—42 per cent less than a year ago.

Automatic tumbler production during September amounted to 4,519,369 dozens, a slight increase over last year's corresponding figure. During the first nine months of 1943 this output amounted to 41,064,636 dozens or a 5 per cent increase over the first nine months of 1942. Shipments of automatic tumblers during September totalled 3,995,577 dozens as compared to 3,829,-

THE GLASS INDUSTRY'S INDEX

Production: Eight Months, January Through August



CURRENT GLASS CONTAINER PRODUCTION

(ALL FIGURES ARE GROSS)

	Production		Shipments		Stocks	
	Sept. 1943	*Sept. 1942*	*Sept. 1943*	*Sept. 1942*	*Sept. 1943*	*Sept. 1942*
Food Containers (Narrow Neck, Wide Mouth and Pressed Ware.)	2,839,769	2,274,081	2,999,202	2,481,853	1,362,104	2,350,954
Pressure and Non-Pressure	365,267	301,238	385,960	314,906	235,222	329,684
Beer Bottles	470,061	585,492	418,908	647,305	231,975	280,214
Liquor Ware	780,057	1,118,800	767,562	1,094,826	536,297	1,477,497
Medicine and Toilet Preparations	1,927,653	1,159,493	1,828,956	1,286,361	1,817,415	2,988,786
General Purpose	577,188	383,519	581,739	360,843	337,328	590,426
Milks	273,577	264,747	264,222	285,715	314,342	330,481
Fruit and Jelly	322,241	210,647	332,959	394,615	28,013	108,675
All Other	33,084	29,748	39,859	30,962	18,911	33,217
Total Industry	7,588,897	6,327,765	7,619,367	6,897,386	4,881,607	8,489,934

029 for September of last year. Total shipments from January to September, 1943, were reported to be 41,372,907 dozens or approximately 7 per cent over the total reported for 1942. Finished stocks on hand at the end of September amounted to 6,952,849 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware were reported at 2,168,372 dozens for September, a 30 per cent decrease from last year's figure.

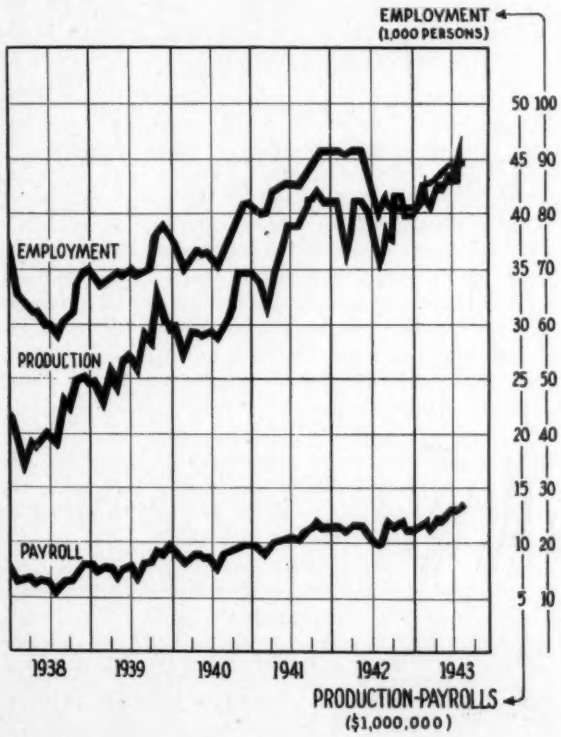
Miscellaneous glass products manufactured in August are estimated at $17,000,000. This figure is an increase of 6 per cent over last month. During the first eight months of 1943 miscellaneous glass products amounted to $129,000,000 as compared to $121,000,000 in 1942 for the same length of time.

Employment and payrolls: The number of persons employed in the glass industry during August was 89,400, a slight increase over the number reported for July. This figure compares with 84,000 employed during August of 1942.

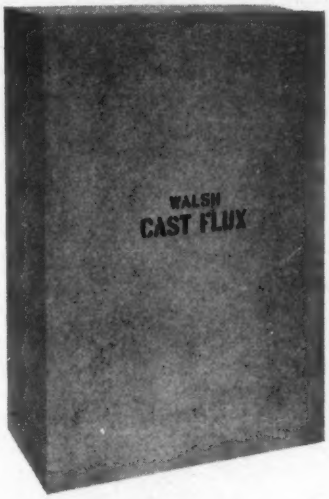
Payrolls in August were estimated at $14,000,000, an increase of $1,000,000 over July. This is an increase of 16 per cent over payrolls of August, 1942. Glass manufacturers have paid out about $113,500,000 in salaries for the first eight months of 1943.

GI THE GLASS INDUSTRY'S INDEX

Monthly Trends Through August, 1943



WALSH CAST-FLUX



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G. C. A. MEETING . . .
(*Continued from page* 479)

Supreme Court. However, Mr. Harmon said he believed that the case would be heard very early in November.

Starting the second day of the meeting, Mr. B. H. Taylor, Traffic Manager of the Association, outlined present traffic problems which are at least as complex as when he made his report at the Annual Spring Meeting.

The War Food Administration was represented by Mr. R. A. Palen. His "Preview of War Food Administration Program for 1944" gave the glassmen a concise picture of the work of this agency in conjunction with the War Production Board as it affects the glass container industry.

The all-important manpower problem was discussed by Dr. Eugene G. Bewkes, Special Assistant Deputy Director of the War Manpower Commission.

The subject of employment and manpower is one in which Dr. Bewkes is well versed, since he has in the past been actively engaged in personnel work in industry and as Dean of the Colgate University, has devoted considerable study to the ramifications of the problem.

In outlining the seriousness of the manpower shortage, Dr. Bewkes stated that the military administration, with 9,300,000 in the armed forces in July, 1943, has asked for an additional 2,000,000 by July, 1944. The munitions industries will require another 2,000,000 workers by the same time, which means a total of 4,000,000 more workers out of industry by July, 1944.

The transfer of workers for munition production out of non-munitions industries is indicated by these demands, but this will only provide a part of the requirements. It is estimated about 600,000 non-muntion workers can be found, the balance required must come from women. In this connection, Dr. Bewkes stressed the use of female employees and also urged a careful study of means to increase labor potentiality.

While Dr. Bewkes had many examples of methods employed by various concerns in diversified industries in their efforts to solve the manpower problem, limited time prevented a detailed presentation of the facts. However, the glassmen were told that his branch stood ready and willing to offer assistance where possible.

The report of the association's Labor Committee was given by Mr. Ralph A. Lind and he discussed at some length proceedings of the wage conferences with the glass unions and other matters pertaining to the glass industry's labor relations.

With regard to employment in the container industry, figures presented showed that in May, 1943, there was a total employment of 37,963, both men and women. This represented an increase of 6.6 per cent over the preceding year.

Of major interest in the data on labor are figures concerning female employment. As in all other fields, the employment of women has materially increased in the container industry. Surveys reveal that female employment has increased by 4,013 women in 1943 over 1942. The great majority of these additional women workers have gone directly into the factory.

Mr. Lind's report shows a very slight increase in the average number of hours per gross, and it is believed that this may be partly due to green labor and, to a limited extent, to the larger container capacities involving heavier ware coming off lines this year.

A very complete table, incorporating the container industry's employment and payroll data from 1929 to 1943, was included in Mr. Lind's report.

It is announced with regret that Harold Boeschenstein, a familiar figure at G.C.A. meetings before he assumed the presidency of the Owens-Corning-Fibreglas Corporation, would be unable to be present as planned to discuss the paper supply situation.

Mr. Hall, however, covered the subject briefly, emphasizing the re-use projects which the War Production Board has been endeavoring to foster through special meetings and through the distribution of booklets describing the general idea of re-use of shipping containers.

In the discussion which followed, one of the leading members of the industry voiced what seemed to be the consensus of opinion among the assembled glassmen that, while the WPB set-up is okay, the program is inadequate to meet the basic problem. He stated that the pulp shortage must be corrected, and compared the situation to that of aluminum and copper in 1942; here there was just no other answer than to get more production. The whole matter is one of relativity; if the need for fiberboard is sufficiently imperative the demand will accelerate production as in the case of the aforementioned products. It was pointed out that steps have already been taken in this direction by the use of Italian war prisoners and the availability of new trucks and saws for timber operation.

Last on the program was a talk by Mr. A. L. Key, on leave from the Hazel-Atlas Company with Containers Branch of WPB in which he discussed simplification and standardization Order 1-103.

In spite of the many and diverse problems confronting the assembled glassmen, the usual spirit of good fellowship prevailed between sessions and after hours. This fact alone is indication of the industry's desire and ability to cooperate in meeting its obligations to the country in time of war.

OLD AGE PENSION RULING FOR WORKERS OVER 65

Employees who are 65 and over are not to apply for Old Age Pension benefits, according to information received from Government sources, until they actually intend to retire from employment. They not only will be ineligible to receive these benefits while employed but their benefit rights will be frozen as of the date of their application although they may continue to work and pay Old Age Pension for many years more.

If workers do not apply for retirement until they actually intend to retire, all taxes paid up to the date of actual retirement will be included in computing the amount of benefit they will be entitled to when they retire.

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DR. JOHN C. HOSTETTER PRESIDENT OF MISSISSIPPI GLASS COMPANY

Will Be Available to Hartford-Empire Company for Consultation

Announcement has been made by the Hartford-Empire Company, Hartford, Connecticut, of the resignation of Dr. John C. Hostetter who, since January, 1937, has served as Vice President and Director of Research and Development. The Hartford company also states that Dr. Karl E. Peiler, for many years with the corporation, has been appointed Acting Director of Research.

Dr. Hostetter leaves Hartford to assume the presidency of the Mississippi Glass Company, St. Louis, Missouri, manufacturers of ribbed and wire glass, and in his new affiliation he will also become Chairman of the Board of the Walsh Refractories Corporation, a subsidiary of the glass company headed by N. S. C. Walsh as president. R. D. Humphreys, until now President of Mississippi Glass, becomes Chairman of the Board of the parent company.

Dr. Hostetter's outstanding achievements in the field of glass technology are so varied and numerous that space limitations prevent detailed elaboration. However, a brief biographical sketch of his activities will be of interest.

Leaving Bucknell University in his Senior Year he went to the University of Chicago to take a course in organic and physical chemistry and later received in absentia the degree of Sc.B. in Chemistry from Bucknell. Following, he was instructor in Chemistry at Bucknell and then served for two years as Assistant Chemist in the United States Bureau of Standards, Washington, D. C. His next work was as physical chemist in the geophysical laboratory of the Carnegie Institute. With the start of World War I the Institute was completely taken over by the government and Dr. Hostetter was successively assigned to the Bureau of Standards in Pittsburgh, the Bausch and Lomb Optical Company, Rochester, New York, and the Charleroi plant of the Pittsburgh Plate Glass Company.

In 1919 Dr. Hostetter joined the Corning Glass Works, Corning, New York, as assistant manager of the Steuben Division—soon after becoming manager.

He thereafter successively held the positions of assistant manager of production in the main Corning plant, manager of the Rhode Island Division of the company and then returned to Corning as production manager of bulbs and tubing. Finally in January, 1930, he was made Director of Development and Research.

It was in this capacity that Dr. Hostetter supervised the pouring in December, 1934, of the world's largest reflecting telescope mirror now in the Mt. Palomar Observatory in California. For his part in producing this internationally famous glass disc Dr. Hostetter was awarded the Howard N. Potts Medal by the Franklin Institute.

In addition to the degree of Sc.B. conferred on Dr. Hostetter by Bucknell University in 1908 he also holds the degrees of Sc.M. 1909, Ch.E. 1930, Sc.D. 1936 from Bucknell and an Sc.D. from Alfred University 1937. In the same year he was awarded the "significant sig medal" of the Sigma Chi fraternity.

Dr. Hostetter is a fellow of the American Ceramic Society, a member of the Ceramic Association of New York, American Chemical Society, American Institute of Chemical Engineers, Franklin Institute, Washington Academy of Sciences, American Society of Military Engineers, National Society of Professional Engineers, Deutsche Glastechnischen Gesellschaft and English Society of Glass Technology.

EMPLOYEE TRAINING PROGRAM

(*Continued from page* 471)

Another lesson dealt with the importance of the use of inspectors' cards and the identification of good as well as poor inspection by the use of suitable cards. In this lesson, the correct method of counting ware to avoid mistakes was gone into quite thoroughly, and the correct way to pack and pad cases, cartons and crates for the safe shipment of bottles was taught.

One lesson covered the correct and most practicable manner to handle and inspect various shapes and sizes of bottles; standing in the proper position, making every move count, holding the bottle at the right angle to get the best light on it and particularly how to manipulate the bottles or roll them in the inspectors' hands without bumping, bruising or otherwise marring them. The importance of keeping the plant clean, the inherent dangers in having broken glass lying around, and the throwing of bottles into cullet cans carelessly was gone into thoroughly.

A lesson in the functions of the polariscope was given and each student was brought to the polariscope individually and shown samples of good, fair and bad annealing in bottles and were then later on called back to identify the different grades of annealing which were shown. This created a great deal of interest.

The succeeding lessons, up to and including the tenth, covered various defects. All students were provided with pads and pencils and many of them made copious notes during the classes, and were always invited to bring their inspection problems into the class room. Quite a number of the girls brought defective bottles into the class, and these defects were also thoroughly discussed, any questions about them were completely answered, and the girls were encouraged to discuss glass faults, their causes, etc., with the foremen of the machine end of the factory.

One of the most important lessons was that concerning gauging. Many of the gauges were brought into the class room, and during the eleventh lesson, the girls were asked to write in their note books short commentaries on the following subjects: Gauging and what it means; and, Descriptions and causes of checks, washboards, laps, frizzles and visual cords.

(*Continued on page* 486)

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for

The Glass Industries

E-X-C-L-U-S-I-V-E-L-Y

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BOOK REVIEW

"How to Maintain Electric Equipment"

The General Electric Company has compiled in this book many of the tips every industrial plant is looking for on how to keep its equipment in top-notch condition. The information contained therein has been prepared by men who have had many years of practical field experience, and the result is a manual that speaks the maintenance engineer's language.

Preventive-maintenance schedules and trouble-shooting charts are included on nearly all types of equipment. Photographs and diagrams give suggestions on what to do to get maximum performance and longest life out of your machinery, and also indicate what constitutes good maintenance procedure and some of the troubles that may arise from improper care.

The many illustrations, dozens of new tables, hitherto unpublished charts, and simple indexing combine to make this book more comprehensive than anything General Electric has ever offered before. There are prominent marginal headings which make it easy to find the material you are looking for, and space has been provided throughout the book for making notes on your own equipment.—General Electric Company—$1.75.

VERGIL MULHOLLAND OF HARTFORD-EMPIRE DIES

Vergil Mulholland, 66, for twenty-seven years a member of the Hartford-Empire Company's staff, and a prominent glass technologist and furnace engineer, died Wednesday, October 13, in Hartford, Connecticut.

Mr. Mulholland was born in Selma, Illinois in 1877 and attended schools in Dayton, Ohio, and St. Louis, Missouri. He also attended the Washington University of St. Louis.

He entered the Hartford-Empire Company in 1916 when it was still the Hartford-Fairmount Company. Previously, he was employed by the Heyl and Patterson Company of Pittsburgh, and the Thatcher Manufacturing Company of Elmira. Mr. Mulholland was largely responsible for the development of the Hartford-Empire Lehr, and he was well known in the glass business for his work on tanks. He was the inventor of some forty-five U. S. Patents relating to lehrs and furnaces.

FIVE CHEMICAL DISTRIBUTORS JOIN DIAMOND ALKALI SALES CORPORATION

In order to more closely correlate the Diamond Alkali field service, sales and warehousing, five heavy chemical distributors became part of the Diamond Alkali Sales Corporation, Pittsburgh, Pa., on October 1.

These five concerns are: Consumers Chemical Company of Philadelphia, C. F. Wolters, Jr., District Manager; Tri-State Chemical Company, Inc., Memphis, Tenn., E. A. Jones, District Manager; The Sunshine Soda Company, Inc., Cleveland, Ohio; Central West Chemical Company, Omaha, Nebraska, V. M. Jacobsen, District Manager; and the Buckeye Soda Products Company of Cincinnati, L. W. Wahl, District Manager.

CONTROVERSY ON DENSITY . . .

(*Continued from page* 473)

be expected to give accurate agreement with observed densities, if either of these densities or the composition data are not sufficiently accurate.

In conclusion, we cannot agree that any of Dr. Scholes' criticisms are warranted.

MAURICE L. HUGGINS
KUAN HAN SUN
Research Laboratories
Eastman Kodak Company

[1]M. L. Huggins, Journal of the Optical Society of America, **30**, 420 (1940).
[2]M. L. Huggins, Industrial and Engineering Chemistry, **32**, 1433 (1940).
[3]M. L. Huggins and K.-H. Sun, Journal of the American Ceramic Society, **26**, 4 (1943).
[4]Anonymous, GLASS INDUSTRY, **24**, 298 (1943).
[5]F. W. Glaze, J. C. Young, and A. N. Finn, J. Research Nat. Bur. Stand., **9**, 799 (1932).
[6]G. W. Morey, "The Properties of Glass," Reinhold, New York, (1938).
[7]P. Gilard and L. Dubrul, Verre and Silicates Ind., **9**, 25, 37, 50 (1938).
[8]J. C. Young, F. W. Glaze, C. A. Faick and A. N. Finn, J. Research Nat. Bur. Stand., **22**, 453 (1939).
[9]K.-H. Sun, H. W. Safford, and A. Silverman, J. American Ceramic Society, **23**, 315 (1940).
[10]G. W. Morey and H. E. Merwin, J. Opt. Soc. Am., **22**, 632 (1932).
[11]S. English and W. E. S. Turner, J. Soc. Glass Tech., **5**, 277 (1921).

LIMITED SUPPLY OF POLYVINYL BUTYRAL TO BE RELEASED FOR CIVILIAN SAFETY-GLASS

The War Production Board Chemicals Division recently announced that limited amounts of polyvinyl butyral will be released for use in civilian safety-glass since there are prospects of increased amounts of this material being made available for essential civilian uses. This resin has been allocated to military and indirect military uses only during the past year.

The proposed allocation policy will be based upon the applicants' past military usage of this resin and it is planned that future allotments will be in a lump sum to each applicant. It is understood, of course, that all military uses must be supplied from this total allotment, the balance then being available for civilian applications.

The total amount of butyral resin available each month for safety-glass will vary to some extent with other military programs. However, a minimum quota for the industry will be established.

NEW REGULATION ON EXPORTING GLASSWARE

Glassware manufacturers who export their products to countries listed below were advised, in a recent Bulletin from the office of Economic Warfare, that since October 1, 1943, goods which are in free supply, destined to satisfactory consignees in these countries, may be exported without an export license or an import recommendation.

The only document required for this class of goods is a statement of cargo availability (BEW 138), and then only in the case of shipments weighing 2,240 pounds or more. Furthermore, import recommendations are waived in the case of goods valued at $25.00 or less, including those remaining under individual license.

The countries affected are: Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela.

J. M. JOHNS NEW GENERAL MANAGER OF INDUSTRIAL SALES AT L-O-F

J. M. Johns is the newly appointed general manager of industrial sales of the Libbey-Owens-Ford Glass Company, it was announced recently.

Mr. Johns joined the company in 1922 and started his work at the Charleston, West Virginia plant. The following year he was sent to Belgium and Switzerland, where he assisted in the installation and initial operation of the Libbey - Owens - Ford window glass machines.

In 1927, Mr. Johns joined the company's sales force and has since held the positions of district sales manager, division sales manager and assistant to the vice president in charge of sales.

In his capacity as general manager of industrial sales, Mr. Johns' work will include supervision of glass for aircraft and other military vehicles.

GENERAL MANAGER INDUSTRIAL SALES DEPARTMENT OF LIBBEY-OWENS-FORD DIES

G. L. Conley, general manager of the Industrial Sales Department of Libbey-Owens-Ford Glass Company, died suddenly early Friday morning, October 8, in Detroit, Michigan.

Mr. Conley spent nearly his entire business life in the glass business. He became associated with Libbey-Owens-Ford in 1927 and prior to that time was connected with another large glass company located in Pittsburgh. After serving as district sales manager in Chicago, Mr. Conley went to Toledo, Ohio, in 1929. He held the post of assistant general sales manager until 1930, when he became manager of safety glass sales, following which he became manager of the eastern sales division. He served in that capacity until his promotion to the position he occupied at the time of his death.

Mr. Conley was born in Minneapolis. He attended Horace Mann Preparatory School, in New York, and the University of Pittsburgh, at Pittsburgh.

• Dr. Alexander Silverman, Head of the Department of Chemistry in the University of Pittsburgh, has transferred the offices of the Department and his famous glass collection from Thaw Hall to Alumni Hall on the University Driveway.

EMPLOYEE TRAINING PROGRAM

(*Continued from page* 483)

For the twelfth and last lesson, each student came to the polariscope and graded certain annealing through it. It was surprising that every girl in the class checked properly the good bottles and even the next grade of annealing was classified 95 per cent correct.

When the written statements were read, it was evident that the new girl inspectors had been cross-examining the men in the plant, which was exactly what the instructor had in mind when he proposed their answering questions in writing. There then followed a review of the glass faults about which they had been taught during the course.

Not the least important in the training program were the trips taken by the students and their instructor to the various local customers' plants where they saw bottles and food jars, etc., going through the processing or other mechanical equipment used by the customers.

At about this time, it dawned upon us that we who are in executive capacities had not done a good job. It also dawned upon us that maybe the foremen might also need some instruction, not only in just how to train new people, but in how to be good foremen generally.

Therefore, arrangements were made with the Training Within Industry group, which is a section of the War Manpower Commission, which long ago realized the necessity for a vast amount of industrial instruction, to conduct two classes of ten foremen each, two hours per day for five days. This is a fairly concentrated ten hour course of instruction, which the foremen seemed to absorb with good results. The Training Within Industry group specializes in a Job Instructor Training Course, commonly known as "J.I.T." wherein they stress at all times the importance of the proper training of the new—either experienced or inexperienced—employee.

The instructors, in many cases, do not work full time for the government. They have other jobs and put in two, four or as many hours as they can on industrial instruction. Certainly the instructors with whom the writer has come in contact are men of capacity, and the ability to do these jobs properly. While the offices of T.W.I. are small, it will be found that they are well scattered throughout the country and any employer needing the boost of some qualified outside instruction to his foremen will find this group well organized and able to help him.

There is not a single thing which has been said in this article which is at all new or unique; it is simply industrial history repeating itself. Those of you who remember the last war know what a tremendous number of foremanship and other training courses were made available just after the war. This war is putting much more stress and strain on the industrial set-up and if the industrial training and foremanship classes were needed so badly after the last war, they are needed more now because our expansion in this war is greater than the expansion which followed the last war, and the need for well trained, capable foremen and other employees will always exist.

In conclusion, the beneficial results obtained in this plant by ourselves, and those purchasing our products, by the care which has been taken to see that all new people in our organization learn their jobs as well and as promptly as possible cannot be over-estimated. Even though more than one-third of our men have gone into the armed services, the harmony of production is being maintained by the thorough training of new people. We do not presume in this factory that any man, including the writer, is essential to the running of this plant, and come what may, we expect to continue to find it necessary to train new people.

USE OF LEAD OXIDE . . .

(*Continued from page* 478)

increase the rate of mullite formation in the clay body used in the foregoing tests, it would be expected that crystalline growth and inversions would be accelerated in other types of bodies.

In order to test this assumption, powdered quartz (potter's flint) was mixed with amounts of Pb_3O_4 in the following steps, namely, 0, ¼, ½, 1, 2, and 4% Pb_3O_4. The mixtures were made up into small bars and fired at 1400° C. for about eight hours. After the furnace had cooled, the bodies were examined with a petrographic microscope and with an X-ray diffraction apparatus.

It was observed that the body without lead oxide consisted of practically unconverted quartz grains, while additions of lead oxide increased the inversion of quartz to cristobalite, the conversion being practically complete in the sample containing 4% Pb_3O_4.

This accelerated rate of inversion may possibly have some application in silica brick manufacture. It is customary at present to fire silica brick at a high temperature for an extended period in order to produce sufficient inversion of quartz to tridymite. By means of lead oxide addition in a small amount it may be possible to accelerate this rate of inversion and so shorten the firing period. In this case the slow volatilization of lead oxide might be advantageous, since the inversion is accelerated by the lead oxide, which is then partly removed by volatilization leaving a silica brick with an unobjectionably small lead oxide residue.

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*Joint contribution of the Department of Ceramic Engineering, University of Illinois, and the Imperial Glass Corporation, Bellaire, Ohio. The authors are indebted to C. G. Harman, Department of Ceramic Engineering, for advice given during the course of this investigation.

[1]For example, see "Remarks on the Influence of Surface Tension in Glass Melting Processes," by H. Jebsen-Marwedel: J. Soc. Glass Tech., Trans. 21, 436 (1937) and "The Effect of Surface Tension on the Formation of Cords," by W. B. Silverman, as presented before the Glass Division, American Ceramic Society, Autumn Meeting, 1940.

[2]Reference may be made to the following publications:

a. C. W. Parmelee and K. C. Lyon: J. Soc. Glass Tech., Trans 21, 44 (1937);

b. C. W. Parmelee and C. G. Harman: J. Am. Ceram. Soc., 20, 224 (1937);

c. A. E. Badger, C. W. Parmelee, and A. E. Williams: J. Am. Ceram. Soc., 20, 325 (1937).

[3]A. E. Badger and H. R. Pinnow: Glass Ind., 22, 161 (1941).

[4]These fragments were taken from glasses used in previous studies of surface tension, as given in Reference 2. (c).

[5]The relative densities of the glasses of course affect the rate at which the fragments sink. The cobalt glass had a density of 2.61 gms. per c.c. at 20° C. and that of the vanadium glass was 2.52. The density of the surrounding soda-lime-silica glass was 2.51 gm. per c.c.

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INVENTIONS . . .

(*Continued from page* 477)

upper edge of the wings. The wings are pivoted at 19 and are loaded or weighted at 23 so there will be a constant pressure urging the sheets to bend just as soon as they become hot enough to start sagging. The wings are curved according to the degree of bending desired. The bending ceases when the wings strike the elements 25 which are stops mounted on the ends of the bending frame.

Other apparatus for bending glass sheets is described in the Libbey-Owens-Ford patent 2,330,279 granted to the late Arthur McK. Greaves-Walker. The sheets held vertically are heated to a softening temperature and then are pressed between male and female plaster molds in a pressing operation requiring less than a second, and likened to die stamping.

J. A. McCormick, Jr., of Forest Park, Ill. (Dearborn Glass Co., Chicago), received patent 2,329,922 for a method of removing discs or other shapes of glass from the center of a sheet. The procedure is to score the enclosed area with a glass cutter and then to heat the rim portion of the sheet while keeping the disc relatively cool. Thermal expansion completes the severance of the disc.

Edwin H. Land's latest Polaroid patent is 2,329,543, in which he describes the forming of a light polarizing surface by depositing a polarizing film of suitably oriented crystals and then dissolving them from the chosen portions to produce any desired design.

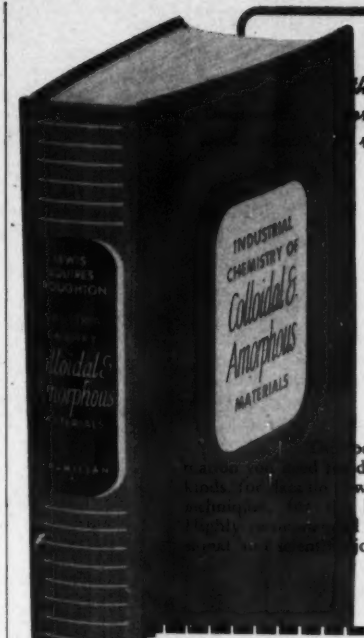
Other sheet or plate glass patents included 2,329,567 to C. M. Verhagen of Elkhart, Ind. (The Adlake Co.), for a multiple glass sash, and 2,330,313 to J. D. Ryan and G. B. Watkins, of Toledo, Ohio (Libbey-Owens-Ford Glass Co.), for laminated safety glass with both the plastic sheet and the adhesive composed of an ethyl cellulose. The ethoxyl content of the sheet is 47 to 48 per cent and that of the adhesive is 35 to 45 per cent.

CHARLES W. RIPPIE JOINS STAFF OF DIAMOND ALKALI COMPANY

Dr. Charles W. Rippie has recently been appointed Supervisor of Technical Service for the Diamond Alkali Company. His headquarters will be in Painesville, Ohio, where the main works operations and the Research and Development Laboratories of this organization are located. In addition to regular technical service, he will work in close collaboration with production, research and sales in establishing the new products developed by Diamond Alkali Company.

Dr. Rippie was graduated from the University of Illinois in 1926 in Chemistry and Mining Engineering. He is an active member of American Institute of Chemical Engineers, American Chemical Society, American Petroleum Institute, Society of Automotive Engineers, and Chemists' Club of New York.

He was formerly employed by Shell Oil Company as assistant to Vice President in the Manufacturing and Sales Divisions, and came to the Diamond Alkali Company direct from the Monsanto Chemical Company.



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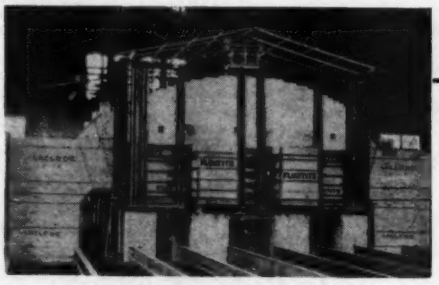

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RESEARCH DIGEST . . .

(*Continued from page* 475)

men are used in making the test. For medical purposes the glass must often be practically free from lead.

The following method will detect lead when no more than 0.005 per cent is present. One grain of the pulverized glass is treated several times in a platinum crucible with concentrated sulfuric and hydrofluoric acids. After evaporation of the excess of sulfuric acid, the residue is digested with water, filtered and washed. The residue remaining on the filter is then tested with the sodium rhodizonate and buffer solutions. The intensity of the red coloration enables one to measure the percentage of lead by comparison with tests executed under the same conditions on samples of glass having known lead contents.

DIAPER SHORTAGE HAMPERS WORK OF OPTICAL INDUSTRY

The Bausch & Lomb Optical Company discloses that a lack of diapers has hampered its war work. The company uses a type of lint-free cloth, commonly made into diapers, for wiping and polishing lenses. While lintless, the cloth will absorb the evidences of washing and handling lens surfaces.

Since more diapers thus mean clearer lenses in bomb sights and cameras the War Production Board is upping diaper production 64 per cent.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF MARCH 3, 1933

THE GLASS INDUSTRY, published monthly at 55 West 42nd Street, New York 18, N. Y., for October 1, 1943, State of New York, County of New York, ss:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared John T. Ogden, who, having been duly sworn according to law, deposes and says that he is the Publisher of THE GLASS INDUSTRY and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, reuired by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: John T. Ogden, publisher, 55 West 42nd Street, New York 18, N. Y. Cyril B. Delgado, editor, 55 West 42nd Street, New York 18, N. Y. Managing editor, none. Cyril B. Delgado, business manager, 55 West 42nd Street, New York 18, N. Y.

2. That the owners are: Ogden Publishing Company, 55 West 42nd Street, New York 18, N. Y. John T. Ogden, 55 West 42nd Street, New York 18, N. Y. Katherine Waller Ogden, 55 West 42nd Street, New York 18, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.)

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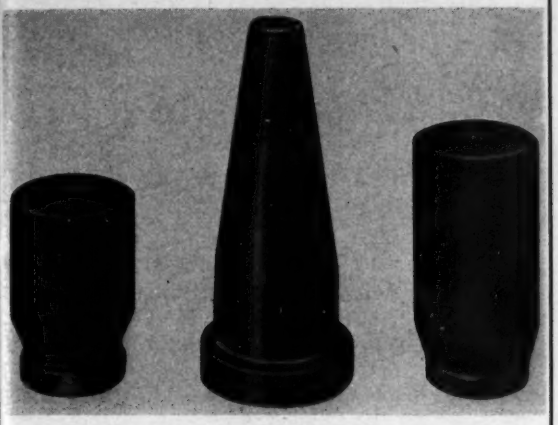

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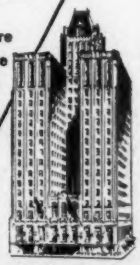

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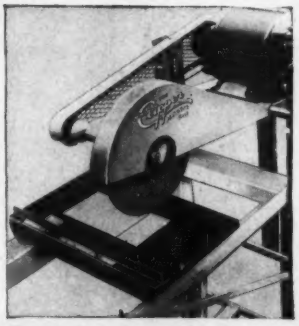

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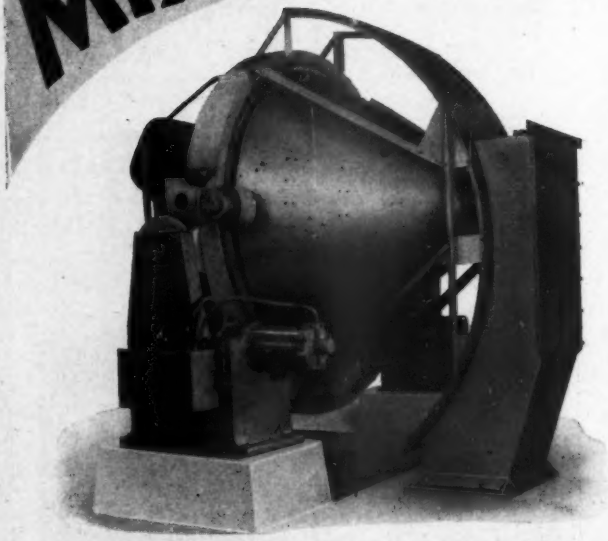

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